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CAREX DUTILLYI: habit, $\times 1$; inflorescences, $\times \frac{1}{2}$

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JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 43.

September, 1941.

No. 513.

A NEW SPECIES OF CAREX AND SOME NOTES ON THIS GENUS IN ARCTIC CANADA

HUGH O'NEILL and MAXIMILIAN DUMAN

This paper is based upon the study of the large collections of *Carex* made during eight consecutive summers in eastern and western Canada by Rev. Artheme Dutilly, O.M.I., as well as those made by the junior author in 1938 at various points from Churchill, Manitoba, to Winter Island in Fox Basin and in Northern Ungava, and our joint collection in 1939 on the coasts of Labrador, Hudson Strait and the eastern coast of Hudson Bay and James Bay. We also had the advantage of studying simultaneously Theodor Holm's large collection of Canadian and arctic Carices in this Herbarium. This includes numerous sheets of *Carex* collected by John and James Macoun, Cox, Low, J. J. O'Neill and others of the Canadian Geological Survey who sent their *Carex* specimens to Holm for determination.

While collecting at Churchill the junior author gathered specimens from a colony of *Carex* growing several hundred yards east of the town, and a few days later discovered a similar colony west of the Churchill River. These specimens, while belonging to the Section *Divisae*, are not referable to any species within that section. We are therefore describing the plant as:

CAREX Dutillyi O'Neill and Duman, sp. nov. TAB. 669.

Rhizoma gracile, 1 mm. crassum, fuscum, squamis linearilanceolatis (10–20 mm. longis) imbricatis, in fibrillis dissolutis, vestitum. Culmi 3–18 cm. alti, apice 0.5–0.6 mm., basi 0.8–1.0 mm., crassi, stricti, distantes, obtusanguli, leves, foliis longiores

interdum breviores. Folia 5-10 in culmo, 2-12 cm. longa, 0.5 mm. lata, involuta, superne leviter scabriuscula; vaginae subarctae antice hyalinae; ligula brevis, 0.1 mm. alta. Spicae 2-4 (raro 1 vel 5), in capitulum subovatum vel lineari-oblongum congestae. Capitulum 5-15 mm. longum, 4-7 mm. latum; spica terminalis androgyna, floribus masculinis conspicuis, perigyniis 3-8. Spicae laterales maturae facile distinguuntur; floribus masculinis inconspicuis; perigyniis 1-6, squarrosis. Bracteae glumis similes, acutae mucronatae. Glumae femininae late ovatae, 3.5 mm. longae, 2.5 mm. latae, apice obtusae vel acutae, castaneae, marginibus hyalinis, centris pallidis, perigyniis fere aequilongae, ea complectentes. Glumae masculinae similes atamen pallidiores angustioresque. Cladophyllum perigyniis simile, 3 mm. longum, 2.8 mm. latum, achenium suffultum. Antherae 1.8-2.3 mm. longae. Perigynia elliptica, 3-4.2 mm. longa, 1.5-1.8 mm. lata, subbiconvexa, fulva (pars exserta castanea), chartacea, utrinque 10-14-costata, haud alata, substipitata, basi spongiosa, in rostrum leve (0.5 mm. longum) abrupte contracta, antice fissum et emarginatum apice hyalinum. Achenia lenticularia, quadrato-ovalia, 1.8 mm. longa, 1.2 mm. lata, fulva, substipitata, subapiculata, laxe inclusa; stylus gracilis; achenio geniculatus; stigmata 2.

Rhizome slender, 1 mm. thick, brown, clothed with overlapping scales, the latter linear-lanceolate, 10-20 mm. long, more or less persisting as a fibrous coat. Culms 3-18 cm. tall, 0.5-0.6 mm. thick at apex, 0.8-1.0 mm. at base, erect, distant, obtusely angled, smooth, longer or sometimes shorter than the leaves. Leaves 5-10 on a culm, 2-12 cm. long (slightly longer in sterile tufts), 0.5 mm. wide, involute, slightly scabrellate toward the apex; sheaths rather close-fitting, hyaline ventrally; ligule a low arched ridge, 0.1 mm. high. Spikes 2-4 (rarely 1 or 5) aggregated in a solitary, irregularly ovoid to linear-oblong head, 5-12 mm. long, 4-7 mm. wide; terminal spike androgynous, the staminate portion conspicuous above the 3-8 perigynia; lateral spikes readily distinguishable at maturity, staminate portion inconspicuous, perigynia 1-6, conspicuously spreading when mature. Bracts resembling the glumes, acute to mucronate. Pistillate glumes broadly ovate, 3.5 mm. long, 2.5 mm. wide, obtuse to acute at the apex, chestnut-brown with lighter center and midrib, wide-hyaline margins, nearly as long as the perigynia and clasping them; staminate glumes similar but lighter colored and narrower. Cladophyllum well-developed at the base of the two lower spikes, 3 mm. long, 2.8 mm. wide, perigynium-like, usually containing a fully developed achene. Anthers 1.8-2.3 mm. long. Perigynia elliptic, 3-4.2 mm. long, 1.5-1.8 mm. wide, nearly biconvex, yellowish brown becoming chestnut brown on

exserted portion, chartaceous, 10–14 ribbed on each face, sub-stipitate, the walls spongy-thickened at the base, slightly angled but not winged, abruptly narrowed into the smooth beak which is 0.5 mm. long, obliquely cleft and emarginate dorsally, its apex and overlapping margins of the orifice hyaline. Achenes lenticular, quadrate-oval, 1.8 mm. long, 1.2 mm. wide, yellowish-brown, short-stipitate, short-apiculate, loosely enclosed; style slender, jointed with achene; stigmas 2.

The systematic position of *C. Dutillyi* in Mackenzie's treatment of *Carex* in the North American Flora (18: 32) is in Section 7, *Divisae*, where it would appear in the key with *C. Eleocharis* Bailey. In Kükenenthal's treatment of *Carex* in Das Pflanzenreich the species should be inserted under Section *Divisae* (4²⁰: 119) where it would appear with *C. stenophylla* Wahlenb., which is the Eurasian counterpart of *C. Eleocharis*.

C. Dutillyi may be distinguished from the above species, and from *C. maritima* Gunn. by the following keys:

Leaves 5–10 to a culm; head irregularly ovoid to linear-oblong, 5–12 mm. long, 4–7 mm. thick; spikes 1–4 (5), distinguishable at maturity; cladoprophyllum perigynium-like, often containing a mature achene; perigynia biconvex, elliptic, 3–4.2 mm. long, sessile; beak smooth, entire; achenes quadrate-oval, 1.8 mm. long, 1.3 mm. wide, substipitate, loosely enveloped. *C. Dutillyi*.

Leaves 1–4 to a culm; head ovoid to oblong, 5–20 mm. long, 5–12 mm. thick, spikes generally more than 5, not readily distinguishable; cladoprophyllum not perigynium-like, sterile; perigynium plano-convex, ovate-orbicular, 2.5–3 mm. long, substipitate; beak serrulate, bidentate; achenes orbicular-ovate, 1.7 mm. long, 1.5 mm. wide, sessile, closely enveloped. *C. Eleocharis* (American plants).

..... *C. stenophylla* (European plants).

Culms erect, straight; spikes 1–5, distinguishable at maturity; head irregularly ovoid to linear-oblong; terminal spike with conspicuous staminate portion; bracts and glumes chestnut-brown with light center and definite midrib and hyaline margins; glumes wider than, and clasping, the perigynia; cladoprophyllum sheathing, perigynium-like and often containing a mature achene; perigynia ribbed ventrally, sessile, chartaceous, not inflated, spongy-thickened at base; achenes quadrate-oval. *C. Dutillyi*.

Culms generally curved; spikes 4–12, nearly indistinguishable; head subglobose or short-ovoid; terminal spike with inconspicuous staminate portion; bracts and glumes thin, completely hyaline to uniformly dark chestnut throughout; glumes slightly narrower than, and not clasping, the perigynia; cladoprophyllum neither sheathing nor bearing an achene; perigynia smooth ventrally, long-stipitate, submembranaceous, slightly inflated, not spongy at base; achenes sub-orbicular. *C. maritima* Gunn.

From the habitally similar *Carex Langeana* Fernald it is distinguished as follows:

Achenes maturing; cladoprophyllum perigynium-like, generally containing mature achenes; glumes castaneous with lighter center and wide hyaline margins; anthers 1.8–2.3 mm. long; leaves smooth, slightly scabrous toward the apex.....*C. Dutillyi*.
 Achenes not known to mature; cladoprophyllum scarcely developed, not bearing an achene; glumes "deep-ferruginous *** with only a narrow pale border"; anthers 1 mm. long; leaves definitely spinulose-scabrous.....*C. Langeana*.

The TYPE specimen (*Duman* 1506, West of Churchill River, Aug. 8, 1938, Churchill, Manitoba) is in the Langlois Herbarium, Catholic University of America. Isotypes will be sent to the Gray Herbarium, U. S. National Herbarium, California Academy of Science, St. Vincent College, etc. COTYPE—*Duman* 1358, East of Churchill, July 30, 1938; ISOTYPE *Dutilly* 6577, West of Churchill River, Aug. 8, 1938, Churchill, Manitoba.

STATUS OF *CAREX SCIRPIFORMIS* MACKENZIE AND EXTENSION OF ITS RANGE.—According to Mackenzie's descriptions of *C. scirpoidea* Michx. and *C. scirpiformis* Mackenzie (N. Am. Fl. **18**: 207), they differ as follows:

Rootstock not fibrillose; glumes with very narrow hyaline margins; perigynia "short whitish pubescent", 2.5–3 mm. long, 1 mm. wide.....*C. scirpoidea*.
 Rootstock fibrillose; glumes with broad white hyaline margins; perigynia "yellowish-brown or greenish-brown hirsute", 2.5–5 mm. long, 1.25 mm. wide.....*C. scirpiformis*.

A study of several hundred specimens collected on the eastern and western shores of Hudson Bay and the Islands in the Bay show that these characters cannot be used to make any definite separation of these specimens. Frequently the specimens exhibit both wide hyaline margins and very narrow hyaline margins on culms from the same tuft, sometimes even on the same spike. This characteristic of the glumes is the best possible separation proposed by Mackenzie; the other characters mentioned are still more unsatisfactory as a means of separating these plants. The form with hyaline margins appears to be most common in Manitoba, especially at Churchill, and in Alberta. On account of the very numerous freely intergrading plants we feel that it is best to treat this plant as a somewhat localized race, having a range on both sides of Hudson Bay in addition to the range given by Mackenzie. We therefore propose the new combination

CAREX SCIRPOIDEA var. **scirpiformis** (Mackenzie) O'Neill & Duman, comb. nov. (*C. scirpiformis* Mackenzie, Bull. Torr. Club **35**: 270. 1908.)

We cite the following specimens as intermediate forms

C. SCIRPOIDEA approaching the var. *SCIRPIFORMIS* *Duman* 1019 (Churchill), 2424 (Sugluk). *Dutilly* 6004, 6841a (Wakeham Bay). *Dutilly, O'Neill & Duman* 87726 (Port Harrison), 87568 (Sleeper Islands), 7725 (Port Manvers), 7833 (Cape Mugford).

C. SCIRPOIDEA var. *SCIRPIFORMIS* approaching the typical form of the species—*Duman* 1038, 1466, 1072 (Churchill). *Dutilly, O'Neill & Duman* 97142 (Cape Jones), 87267 (Wakeham Bay), 87799 (Frazier Island).

STATUS OF *CAREX DRUMMONDIANA* DEWEY.—Some of the more robust, southern plants of *C. rupestris* *Bellardi* of our collection suggested the possibility that *C. Drummondiana* might enter our area, and prompted a study of the status of that plant. It was originally described by Dewey (Am. Jr. Sc. **29**: 251 1836), and reduced to the status of a variety by Bailey, Cat. N. Am. Car. 4 1884). Mackenzie (N. Am. Fl. **18**: 220) recognizes it as a valid species with a range in the Canadian Rockies and the high mountains of central Colorado. Kükenthal (Pflanzenreich **4**²⁰: **86** 1909) places it in the synonymy of *C. rupestris* without comment.

The following table gives the characters generally used in separating these two species, for a number of specimens. (A typographical error in Mackenzie's key should be noted, viz. leaves 1-3 mm. wide, not 1.3 mm. p. 219.)

	Scales concealing perigynia	Spike mm. thick	Culm mm. thick	Leaves mm. wide
<i>Clokey</i> 3697 Colorado	(1)	3	0.4-0.6	1.5-2.0
<i>Clokey</i> 3319 Colorado	immature	3	0.6-0.8	1.5-3.0
<i>Grøntved</i> 198 Greenland	immature		0.6-0.8	1.5-3.0
<i>Holm</i> in 1886 Greenland	(2)	3	0.6-1.0	0.8-2.0
<i>Jansen</i> 8/7/36 Greenland	(2)	3.5	0.6-1.0	1.0-2.0
<i>Kükenthal</i> in 1900 Tyrol	yes	3	0.5-0.8	2
<i>Montell</i> in 1935 Lapland	yes	2	0.6-0.7	1.0-1.5

A study of about 80 other sheets of this species from Siberia, Scandinavia, Russia, Ural Mountains, Ellesmere Island, Hudson Bay Region, Alberta, Colorado, etc., shows that in specimens from all these localities the glumes may, or may not, conceal

the perigynia, the spike may be stout or slender, the perigynia may be separated or not, the leaf-blades may be wide or narrow. These observations lead us to accept without qualification Kükenthal's placement of *C. Drummondiana* in the synonymy of *C. rupestris Bellardi*.

The use by Kreczetowicz (Fl. U.R.S.S. 3: 381 1935) of "*Bellardi ex Allioni*" calls attention to a part of Allioni's preface (Fl. Pedem. 1: IV 1785) which evidently has often been overlooked, but which clearly bears out Kreczetowicz, namely, that Allioni "*sequenti signo †*" designates those species of which "*alter auditor meus Cl. Ludovicus Bellardi*" is the author. The following Carices are marked with the † and hence are to be credited to Bellardi: *C. rupestris*, *C. Bellardi* (incongruous as this may seem), *C. bipartita*, *C. nigra*, *C. bicolor* and *C. trigona*.

THE STATUS OF CAREX PHYSOCARPA PRESL AND CAREX MILIARIS MICHX.—Mackenzie (N. Am. Fl. 18: 445–450 1935) in section *Vesicariae* lists three species, *C. miliaris* Michx., *C. saxatilis* L., and *C. physocarpa* Presl, as having stigmas typically two in contrast to the rest of the section having stigmas typically three. The ranges given for these three species are respectively:

C. MILIARIS, Labrador, Newfoundland, Quebec and central Maine.

C. SAXATILIS, Greenland, Labrador and Arctic Eurasia.

C. PHYSOCARPA, Pribolof Island, Upper Yukon, Mackenzie, south to the mountains of Utah and Colorado, Hudson Bay.

Most authors hold views at variance with Mackenzie's treatment; in fact, all authors consistently disagree with each other in treating this group. Thus Kükenthal (Pflanzenreich 4²⁰: 719, 727–728 1909), while recognizing *C. miliaris* as a species, considers *C. saxatilis* as a subspecies of *C. vesicaria* L., and *C. physocarpa* as: *C. vesicaria* L. subsp. *saxatilis* "L." Kükenthal var. *physocarpa* (Presl) Kükenthal.

L. H. Bailey (Bot. Gaz. 9: 119–120 1884) treats *C. saxatilis* as a species of which *C. miliaris* is a variety, and in this he is followed by Fernald (RHODORA 3: 50 1901). Later Bailey (Mem. Torr. Bot. Club 1: 35–36 1889) accepted *C. miliaris* as a species distinct from *C. saxatilis* "with which it has no immediate affinity."

Polunin (Bot. Can. E. Arctic 1: 135 1940) treats *C. miliaris*

as a variety of *C. saxatilis*, commenting that the latter is "a very complex and variable species which in the western parts 'runs into' phases of the next two." [evidently *C. miliaris* and *C. physocarpa*].

Hultén (Fl. Aleut. Isl. 119–120 1937), while recognizing *C. physocarpa* as a species, comments that it is closely related to *C. saxatilis*.

On one point, at least, all authors, including Drejer (Rev. Crit. 56 1841), Tuckerman (Enum. 13 1843), Lange (Fl. Dan. 48 pl. 2850 1871), Akiyama (Jr. Fac. Sc. 2¹: 226 1932), Hultén (l.c.), Ohwi (Mem. Coll. Sc. 11⁵: 500 1936), Kreczetowicz (Fl. U.R.S.S. 3: 448–449 1935), and Polunin (l.c.), [except Küken-thal (l.c. 727)], agree; viz. that *C. saxatilis* should be treated as a species rather than a subspecies.

From an examination of nearly a thousand specimens of this group and of *C. vesicaria* we agree with the consensus of opinion that the two stigmas of this group is a sufficiently sharp distinction between it and *C. vesicaria* with its three stigmas. Drejer (l.c.), Lange (l.c.), Ostenfeld (Fl. Arct. 1: 95 1902), and Ostenfeld and Grøntved (Fl. Iceland and Faer. 35 1934) accept the specific rank of *C. saxatilis* [under the name of *C. pulla* Good. although Goodenough's name (1797) is antedated by *C. saxatilis* L. (1753)].

Th. Holm (Am. Jr. Sc. 10: 271 1900) considers specimens from Kadiak, Alaska (Walter Evans 316 in Catholic University Herb.) as better referable to *C. physocarpa* "than to *C. compacta* R. Br. [*C. membranacea*], but neither this nor *C. physocarpa* is well understood, thus the identification is very uncertain."

C. ambusta Boott is considered a synonym of *C. physocarpa* by Küken-thal (l. c. 728), Mackenzie (l. c. 448) and Hultén (l. c. 119), although Bailey (l. c. 40) treats it as a distinct species. The type specimen from Sitka, Alaska, is in the Prescott Herbarium, Oxford, and is well illustrated in Boott's "Illustrations of the Genus *Carex*", 1858. Boott later on, in vol. 4, refers this species to *C. salina* Wahlenb., which view is reflected in Bailey's earlier publication (*C. salina* var. *ambusta* Bailey in *Carex* Cat. 1884). Commenting on *C. ambusta*, Bailey (l. c.) says, "This is a good species to be separated from *C. saxatilis*, its nearest ally, by * * * perigynium nearly lanceolate, gradually

long-pointed and spreading, possessing none of that shiny, papery and inflated appearance so characteristic of most of the *Vesicariae*; scales much longer and acute or muticous; lower spike on a short but slender peduncle. Ungava Bay (Turner); British Columbia (Rothrock) to Alaska".

A reference to Boott's illustration clearly shows an ovate, short-pointed perigynium, with the lower spike on a very long peduncle. Boott's type-specimen, illustration and description correspond so closely to Presl's type-specimen and description that the view of Kükenthal, Mackenzie and Hultén seems hardly debatable. We have found it sufficiently difficult to segregate *C. physocarpa* and quite impossible to separate *C. ambusta* from *C. physocarpa*. Further, Turner's specimen from Ungava and Rothrock's from British Columbia are clearly *C. physocarpa*. Kükenthal (l. c. 728) cites Turner's specimen as *C. physocarpa*.

Mackenzie (l. c. 446) separates *C. physocarpa* from *C. saxatilis* by means of the following key:

Ligule longer than wide, or about as long as wide; basal sheaths reddened, breaking and becoming filamentose; style strongly bent downward against achene at maturity; achene broadly ovoid or obovoid.....*C. physocarpa* Presl.
 Ligule very short; basal sheaths little or not at all reddened and not breaking and becoming filamentose; style flexuous; achene suborbicular.....*C. saxatilis* L.

Taking these characters in the order given, we find first of all that the wording is rather ambiguous. "Ligule longer than wide" is illustrated in Mackenzie's North American Cariceae, pl. 511, as a very short ligule about 0.3 mm. long (according to scale), while the ligule figured on pl. 512 for *C. saxatilis* is 1 mm. long. From this it is evident that Mackenzie really means that the ligule in *C. physocarpa* is long in the sense that it is high-arching, while the ligule in *C. saxatilis* is short in that it is scarcely arching. Mackenzie refers to the plate of *C. saxatilis* in Fl. Dan. (pl. 2850) as excellent, and bases his treatment on that plate. While it is true that this drawing of *C. pulla* (*C. saxatilis*) is beautifully done, the ligule is the least accurate feature of the plate. Further, European specimens of *C. saxatilis* commonly show exactly the same ligule as is figured in Mackenzie's plate 511 for *C. physocarpa*; e. g. *Baenitz* 2680 (Norway) has ligules which

are just as high-arching (long) as those figured for *C. physocarpa* (pl. 511), or as any specimen of this species from the Canadian Rockies and Alaska. The drawing for *C. saxatilis* (pl. 512) was based on a specimen from Jemtland, Sweden (*DuRietz* July 30, 1911). In the Catholic University Herbarium there is a specimen collected by Beurling and Lagerheim, Aug. 1843, also from Jemtland, which agrees in all features with pl. 512 except that the ligule is high-arching. From this it is clear that the ligule is not only worse than useless as a separating character, but extremely misleading as well.

The second character used to separate these two entities is sheaths "not at all reddened" in *C. saxatilis*. Out of 28 sheets of this species from Greenland, Iceland, Faeroes and Scandinavia in the Catholic University Herbarium, six show considerable reddening of the sheaths, while M. P. Porsild's specimen from Disco Island (July 29, 1935) is red enough to use at a bull-fight. On the other hand, out of 40 specimens of *C. physocarpa* from the Rocky Mountains and Alaska 27 are not red, although Mackenzie's key calls for "basal sheaths reddened". These specimens were all determined as such by Holm, a number of them by Mackenzie, F. J. Hermann, J. W. Stacey, etc., and all were verified by the present authors.

Equally valueless as redness of sheaths is the property of breaking into filaments, since the European specimens show it as much or, better, as little as the specimens from the Rocky Mountains and Alaska.

The last differentiating characters mentioned are "style flexuous, achene suborbicular" in *C. saxatilis*, and "style strongly bent downward against achene at maturity, achene broadly ovoid or obovoid" for *C. physocarpa*. The following table shows how useless these characters are for separating the plants in question.

C. SAXATILIS L.

	Style	Achene
1. <i>Grøntved</i> 280. Greenland.	Looped downward, but not appressed.	Broadly pyriform 1.5 × 1.4 mm.
2. <i>Seidenfaden</i> 221 Greenland.	Looped downward and appressed.	Obovate 2.1 × 1.7 mm.
3. <i>Porsild</i> 7/29/35 Greenland.	Conspicuously looped downward and appressed.	Broadly obovate 1.8 × 1.5 mm.

C. PHYSOCARPA Presl

4. Dawson 13413 Yukon (Cited by Kükenthal as <i>C. physocarpa</i> l. c. 728.)	Erect, not looped.	Broadly pyriform 2.0×1.5 mm.
5. Piper 4832. Unalaska.	Conspicuously looped and appressed.	Broadly obovate 2.0×1.7 mm.
6. Cox 647 Colorado. (Det. by Hermann.)	With two rt. angles, not looped, not appressed.	Broadly pyriform 2.0×1.5 mm.
7. Howell 1698 Alaska.	Looped and appressed.	Obovate 2.1×1.6 mm.

A few other differences between these two plants, as given by Mackenzie in the text, should be noted. The styles of *C. physocarpa* and *C. miliaris* are described as "blackish"; in *C. saxatilis* they are described as "whitish." As a matter of fact, the styles are equally very dark in all three plants. In the young stage the stigmas of all three plants have a white, somewhat scurfy coat, most pronounced in *C. physocarpa*, and not in *C. saxatilis*, as stated by Mackenzie. In old specimens of all three the white scurf is shed, and all are equally dark.

The width of the spikes as given by Mackenzie is 6–9 mm. for *C. saxatilis*, and 6–12 mm. for *C. physocarpa*. In all material examined in the Catholic University Herbarium the spikes of *C. saxatilis* were 4–5 mm. wide, and those of *C. physocarpa* were 6–10 mm. wide. (Kükenthal gives 6–12 mm. wide for this latter species.)

Kükenthal (l. c.) also gives certain distinguishing characters for *C. saxatilis* and *C. physocarpa* which may be summed up in the following key:

Staminate spike subsolitary, subclavate-cylindric; upper pistillate spike ovate and sessile, lower pistillate spike oblong-ovate and short-peduncled; perigynia 3–3.5 mm. long.....*C. saxatilis* L.
Staminate spikes two, cylindric; upper pistillate spike short-peduncled, erect, lower pistillate spike long-peduncled and nodding, both of them oblong-cylindric; perigynia 4 mm. long.....*C. physocarpa* Presl.

Taking these characters in the order given, out of 91 plants of *C. saxatilis* from Greenland, Iceland, Faeroes and Scandinavia the staminate spikes were solitary in 85 and twinned in 6. On the 80 plants of *C. physocarpa* from the Rocky Mountains and Alaska the staminate spikes were solitary in 54 and twinned in 26. These figures show that two staminate spikes to a culm is

more common in *C. physocarpa* than in *C. saxatilis*, but that it has little diagnostic value. Further, the tendency of the staminate spike to be subclavate is common in *C. saxatilis* and relatively rare in *C. physocarpa*, but this is likewise only a prevailing tendency, not a decisive means of distinguishing these plants.

The next character, "upper pistillate spike sessile and ovate", seems to hold in nearly all specimens of *C. saxatilis* examined, while the "lower pistillate spike short-peduncled" is shown by 95% of the specimens of *C. saxatilis* examined. On the other hand, in nearly all the specimens of *C. physocarpa* where there are two pistillate spikes, the lower is conspicuously very long-peduncled, i. e. with a peduncle 1-3 times as long as the spike, while the upper pistillate spike is very rarely sessile, but usually short- to long-peduncled. In specimens of both *C. saxatilis* and *C. physocarpa* where the pistillate spike is solitary, the peduncle may be long or short.

Measurements of the perigynia made on specimens in the Catholic University Herbarium indicate that they should be amended to read: *C. saxatilis* 3-4 mm. long; *C. physocarpa* 4-5 mm. long, as stated by Mackenzie (l. c.).

The summing up of the differences between typical plants of these two entities results in the following key:

- Pistillate spikes 4-5(6) mm. wide, the upper ovate and subsessile, the lower spike oblong, short-peduncled, rarely long-peduncled (if the spike is solitary it may be long or short); perigynium 3-4 mm. long; staminate spike subclavate-linear, rarely linear.....*C. saxatilis* L.
- Pistillate spike 6-10 mm. wide, oblong, the upper short-peduncled (very rarely sessile), the lower long-peduncled, i. e. the peduncle $\frac{1}{2}$ to 3 times the length of the spike (if the pistillate spike is solitary it may be either long or short); perigynium 4-5 mm. long; staminate spike linear, rarely subclavate.....*C. physocarpa* Presl.

In the preceeding discussion only plants from two separate ranges have been cited. The wealth of material recently collected by Père Dutilly and the authors in the Hudson Bay region, a region intermediate between the two ranges, now remains to be discussed. This material is intermediate between *C. saxatilis* and *C. physocarpa* as shown by the size of the perigynia, the width of the pistillate spikes, the length of the peduncles, the shape of the staminate spike, and the general aspect of the whole

plant. Very similar forms occur on the peaks of Colorado where they are always called *C. physocarpa*. On the other hand these plants are closely matched by material from Greenland where they are always called *C. saxatilis*. In fact, if the plants from Scandinavia, Faeroes, Iceland, Greenland, Hudson Bay Region, Rocky Mountains, Pacific Coast and Alaska are arranged in the order named, a series of insensibly intergrading forms results. A dividing line drawn anywhere in this series is just as good, or just as bad, as a line drawn anywhere else. Accordingly, we follow Kükenthal (l. c.) in treating *C. physocarpa* as a variety of *C. saxatilis* (which, however, he considered a subspecies). The earliest available name seems to be *Carex saxatilis* var. *major* Olney in S. Wats. Bot. King's Expl. 370 1871. This publication is the "U. S. Geological Exploration of the 40th Parallel; Clarence King, Geologist in Charge; Vol. V Botany, by Sereno Watson, 1871." There seems to be no indication in the original description that it is Olney's, but Watson in his "List of Plants Collected in Nevada and Utah 1867-1869" (No. 1248) which is part of the same series, and published in the same year, credits the plant to Olney.

If a dividing line must be drawn between the species and the variety, it seems best to consider the material from the Hudson Bay region as an extreme form of the var. *major*, and to restrict *C. saxatilis* to arctic and subarctic Eurasia, Iceland and Greenland.

We find that we can segregate, as such, the plants of New England and southern Canada by using the key given by MacKenzie (l. c.), but the following key enables us to separate *C. saxatilis* var. *miliaris* more surely from var. *major*.

- Perigynia 2.5-3.5 mm. long, tightly investing the achene, unequally lenticular, the empty space above the achene small, less than $\frac{1}{4}$ the body of the perigynium; anthers 1.5-2.5 mm. long; leaves 1-2(3) mm. wide; staminate spike narrowly linear, 1-2 mm. wide; lower pistillate spikes sessile or short-peduncled, erect, 4-7 mm. wide; lowest bract 0.5-1.0 mm. wide.....*C. saxatilis* var. *miliaris* (Michx.) Bailey.
- Perigynia 3.2-5 mm. long, more or less inflated, the empty space above the achene often $\frac{1}{3}$ to $\frac{1}{2}$ the body of the perigynium; anthers 2.5-3 mm. long; leaves 1.5-5 mm. wide; staminate spike linear to linear-subclavate, 2-4 mm. wide; lower pistillate spikes short- or long-peduncled, 6-10 mm. wide; lowest bract 1-2 mm. wide.....*C. saxatilis* var. *major* Olney.

However, in the Hudson Bay region numerous forms intergrade so closely between *C. saxatilis* var. *major* and var. *miliaris*, that we feel justified in also treating the latter as a variety, as do Fernald (RHODORA 3: 50 1901) and Polunin (Bot. Can. E. Arct. 1: 135 1940). In many cases, e. g. *Duman* 1413, 1392, 1238, 1307, all from Churchill, Manitoba, the plants are exactly intermediate between the two varieties.

As to the arctic distribution in North America of these two varieties, we would limit *C. saxatilis* var. *miliaris* to the subarctic area of Quebec and Labrador, and *C. saxatilis* var. *major*, while becoming more typical as it approaches Colorado and the Rocky Mountains, is found both in the eastern and western arctic and subarctic. The line separating the varieties in Quebec and Labrador is not sharp.

CATHOLIC UNIVERSITY OF AMERICA.

A MONOGRAPHIC STUDY OF *ARABIS* IN WESTERN NORTH AMERICA

REED C. ROLLINS

(Continued from page 411)

30. *A. KOEHLERI* Howell. Perennial; caudex much-branched, woody, covered with peg-like leaf-bases; stems slender, simple, numerous, entirely glabrous to sparsely pubescent below, 5–30 (–40) cm. high; basal leaves numerous, linear to narrowly oblanceolate, acute, entire, stellate-pubescent, 1–2 cm. long, 2–4 mm. wide; cauline leaves sessile, lanceolate, auriculate, slightly clasping, entire, glabrous or nearly so, remote to overlapping, 1–2 cm. long; sepals oblong, often purplish, sparsely pubescent, 3.5–5 mm. long, 1.5–2 mm. wide, non-saccate; petals scarlet to deep purple, nearly oblong but with a short narrow claw, 7–10 mm. long, about 3 mm. wide; glandular tissue well developed, continuous beneath all stamens; pedicels ascending to divaricate, glabrous, 1–2 cm. long; siliques divaricately spreading, arcuate, glabrous, attenuate at apex, 5–8 cm. long, about 2 mm. wide; style short or absent; seeds orbicular, narrowly winged, about 1.5 mm. broad including wing, uniseriate.

Siliques sessile, only slightly curved; cauline leaves few,
remote.....30a. Var. *typica*.
Siliques shortly stipitate, strongly recurved; cauline leaves
numerous, imbricated.....30b. Var. *stipitata*.

30a. Var. **typica**. *A. Koehleri* Howell, Fl. Northw. Am. **1**: 44 (1897); Rollins in Res. Stud. State Coll. Wash. **4**: 21 (1936) in part. *A. arbuscula* Greene, Leaflets **2**: 77 (1910).—Southwestern OREGON: bluffs, Roseburg, Douglas Co., April 17, 1887, *T. Howell s. n.* (O, TYPE; G, NY, T, isotypes), April & May, 1914, *Cusick 3950* (G, R, WSC), June, 1916, *Peck 6955* (WSC), April, 1934, *Thompson 10157* (NY, T, US); Mt. Nebo, near Roseburg, May, 1924, *Ingram 1498* (FS). Eight Dollar Mt., Josephine Co., June 18, 1904, *Piper 5056* (US, TYPE; G, isotype of *A. arbuscula*).

30b. Var. **stipitata**, var. nov. Herba perennis; caulibus 1.5–4 dm. altis; foliis caulinis imbricatis auriculatis; siliquis arcuatis stipitatis 5–6 cm. longis, ca. 2 mm. latis.—Josephine County, OREGON: Camp Chicago Trail near Waldo, April 19, 1934, *Alice Eastwood & John T. Howell 1695* (G, TYPE); Redwood Highway at north fork of Illinois River, April, 1934, *Eastwood & Howell 1432* (G); Kerby, May, 1922, *Sweetser 5748* (WSC); O'Brien, April, 1934, *Thompson 10275* (M, NY, T, US, W); Eight Dollar Mt., May, 1884, *T. Howell 34* (G).

The caudex is woody, strongly developed and highly branched in *A. Koehleri*, which gives it a distinctive appearance. The caudex-branches are covered with stiff peg-like leaf-bases making them resemble naked spruce-twigs. Ordinarily, the cauline leaves are few and remote, the basal leaves linear and the sessile siliques only slightly curved. However, some of the plants from Josephine County have numerous crowded cauline leaves, broader basal leaves and rather strongly recurved, shortly stipitate siliques. The latter I have called var. *stipitata*.

A. Koehleri is perhaps most closely related to *A. Breweri*, but the pubescence of the two species is wholly unlike. *A. Koehleri* has a moderately fine, truly stellate pubescence upon the basal and lower cauline leaves and is glabrous on the upper stem and pedicels. In *A. Breweri*, the leaves are covered with forked or dendritic trichomes and the stems and pedicels are hirsute with mostly simple spreading hairs.

31. *A. MICROPHYLLA* Nuttall. Perennial; stems slender, several to numerous from a subterranean, branching caudex, few-flowered, simple or occasionally branched, glabrous above, somewhat hirsute with spreading simple or forked trichomes below or rarely glabrous, 1–5 (–7) dm. high; basal leaves linear to narrowly oblanceolate, entire, acute, densely pubescent with small dendritic trichomes, not pannose but appearing so to the naked eye, rarely almost glabrous, 5–20 mm. long; cauline leaves few, narrowly

lanceolate, auriculate, glabrous or the lower pubescent, 1–2 cm. long; sepals oblong, non-saccate, glabrous or rarely sparsely pubescent, green to purple-tinged, 2–3.5 mm. long; petals pale-rose to purplish, 4–6 mm. long, spatulate to cuneate; glandular tissue continuous beneath all stamens, weakly developed; pedicels slender, divaricate to more ascending, glabrous or rarely pubescent, 5–15 mm. long; siliques erect to obliquely spreading, straight to somewhat curved, narrow, blunt to slightly attenuate, glabrous, faintly nerved toward base, 2–6 cm. long, 1–1.5 mm. wide; style less than 1 mm. long or obsolete; seeds orbicular, small, narrowly winged, about 1 mm. broad, uniseriate (imperfectly biseriate in var. *saximontana*).

KEY TO THE VARIETIES OF *A. MICROPHYLLA*

- a. Siliques few on each stem, straight, erect to divaricate; plants usually less than 2 dm. high.....b.
- b. Style absent or very short; pubescence fine.....c.
- c. Siliques erect, nerveless or only faintly nerved; caudex highly branched.....31a. Var. *typica*.
- c. Siliques rigidly divaricate, nerved at base; caudex simple or branched only a few times; Wyoming and Idaho 31d. Var. *saximontana*.
- b. Style about 1 mm. long; pubescence coarser; plants of Washington.....31c. Var. *Thompsonii*.
- a. Siliques numerous on each stem, slightly curved, obliquely spreading; plants usually about 3 dm. or more high. 31b. Var. *Macounii*.

31a. Var. **typica**. *A. microphylla* Nuttall ex T. & G., Fl. N. Am. **1**: 82 (1838); Watson in Gray, Syn. Fl. N. Am. **1**: 167 (1895); Howell, Fl. Northw. Am. **1**: 41 (1897); Piper in Contrib. U. S. Nat. Herb. **11**: 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. **227** (1909); Rydberg, Fl. Rky. Mts. **359** (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25**: 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4**: 38, fig. 11 (1936). *A. tenuicula* Greene, Leaflets **2**: 82 (1910).—Montana and Wyoming to Nevada and Washington. MAP 16. LOCALITY UNCERTAIN: Rocky Mountains, *Nuttall* (photo of type in Gray Herb.). MONTANA: Mt. Helena, Sept. 10, 1882, *F. W. Anderson* (NY). WYOMING: Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson* 5726 (G, M, NY, RM, US); Yellowstone Park, July, 1885, *Tweedy* 554 (G, US); near Leekie, Sublette Co., June, 1901, *Merrill & Wilcox* 634 (G, NY, US). IDAHO: Lime Point, Nez Perce Co., May, 1926, *St. John* 4374 (WSC); between Willow Cr. and Steep Cr., Idaho Co., May, 1936, *Rollins, Constance & Dillon* 1106 (G, R, WSC); Granite Cr., Idaho Co., April, 1935, *Constance et al.* 1014 (R, WSC); Gold Fork Lookout, Sawtooth Mts., Valley Co., July, 1937, *Thompson* 13743 (G, R); near Patterson, Lemhi Co., July, 1916, *Macbride & Payson* 3186 (G, M, RM, US); Bear Cr., be-

low Parker Mt., July, 1916, *Macbride & Payson 3304* (M, RM, US); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3066* (G, RM, US); Ketchum, July, 1911, *Nelson & Macbride 1193* (G, RM). UTAH: Green Canyon, Cache Co., May, 1935, *B. & C. B. Maguire 15033* (G, R, UAC), May, 1932, *Burke 3449* (G, M, UAC); Logan Canyon, Cache Co., April, 1934, *B. & R. R. Maguire 15034* (R, UAC); Farmington Canyon, Wasatch Co., May, 1903, *Stokes s.n.* (NY); Big Cottonwood Canyon, Salt Lake Co., May, 1908, *Garrett 2237* (G); Parley's Canyon, April, 1908, *Garrett 2222* (G); Thistle, Utah Co., June, 1898, *Jones 6162* (M, US). NEVADA: Thomas Falls, 34 miles west of Elko, Eureka Co., June, 1937, *Breene 481* (NA); 6 miles west of canyon mouth, South Twin River, Toiyabe Mts., July, 1938, *Rollins & Chambers 2530* (G, R). OREGON: Jim Cr., Wallowa Co., June, 1897, *Sheldon 8303* (G, NY, UC, US); mouth of the Innaha River, Wallowa Co., March, 1935, *Constance 1000* (R, WSC); mouth of Deep Cr., Wallowa Co., May, 1936, *Rollins, Constance & Dillon 1105* (G, R, WSC); crevices of cliffs, Union Co., May, 1883, *Cusick 1124* (US, type; G, isotype of *A. tenuicula*); basaltic cliffs near Union, June, 1909, *Cusick 3340* (R, US, WSC); above Alvord, Steens Mts., June, 1927, *Henderson 8409* (O); head of Willow Cr., Steens Peak, June, 1936, *Peck 19047* (R); Canyon City, Grant Co., July, 1921, *Peck 10164* (W); Rowena, Wasco Co., April, 1902, *Sheldon S. 10168* (G, O, NY, US, WSC); Mitchell Point, Hood River Co., April, 1920, *Suksdorf 2202* (WSC). WASHINGTON: east of Bishop, Whitman Co., May, 1936, *Rollins & Constance 1090* (G, R, WSC); Table Rock, Columbia Co., July, 1935, *Constance et al. 1274* (R, WSC); Williams Ridge, Columbia Co., July, 1913, *Darlington 123* (WSC); Lime Point, Asotin Co., April, 1928, *St. John 9292 & 9293* (WSC); Angell's Pass, Okanogan Co., July, 1931, *Fiker 260* (T); near Entiat, Chelan Co., April, 1931, *Thompson 6377* (G, OS, T, UW); base of Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10530* (G, NY, RM, T, UW); Bingen, Klickitat Co., April 28, 1881, *Suksdorf 11695* (WSC), March, 1886, *Suksdorf 14* (G, R, WSC); White Salmon, March, 1886, *Suksdorf s. n.* (G); Prindle, Skamania Co., May, 1924, *Suksdorf 11695* (WSC).

31b. Var. **Macounii** (Watson), comb. nov. Stems numerous, 2.5–5 (–7) dm. high; basal leaves denticulate to entire; pedicels obliquely spreading, slender; siliques numerous on each stem, slightly curved to arcuate, widely spreading.—*A. Macounii* Watson in Proc. Am. Acad. **26**: 124 (1891) and in Gray, Syn. Fl. N. Am. **1**: 163 (1895); Rydb., Fl. Rky. Mts. 360 (1918). *A. densicaulis* A. Nelson in Bot. Gaz. **30**: 190 (1900); Rydb., Fl. Rky. Mts. 362 (1918).—Montana to Utah, Idaho and British

Columbia. MAP 16. MONTANA: without locality, *F. Tweedy* (US). WYOMING: Undine Falls, Yellowstone Park, July, 1899, *A. & E. Nelson 5680*¹ (RM, TYPE; G, isotype of *A. densicaulis*); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2857* (G, R); east of Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3370* (RM). IDAHO: upper Priest River, June, 1925, *Epling 7255* in part (UCLA); Rapid River, Custer Co., Aug., 1916, *Macbride & Payson 3608* (G, M, NY, RM, UC, US); Wild Horse Creek, Custer Co., July, 1939, *Davis 1205* (R); near Stanley Lake, July, 1937, *Thompson 14034* (G). UTAH: Mill Creek Canyon, Salt Lake Co., June, 1905, *Garrett 1201* (G, NY, RM); Fort Douglas, July, 1918, *J. F. Brenkle s.n.* (G). BRITISH COLUMBIA: Revelstoke, May 13, 1890, *John Macoun s.n.* (G, TYPE; M, US, isotypes).

31c. Var. **Thompsonii**, var. nov. Herba multicaulis; caulibus erectis ca. 1 dm. altis; siliquis acuminatis; stylis ca. 1 mm. longis.—WASHINGTON: alpine meadows of Table Mt., Kittitas Co., July 3, 1933, *J. W. Thompson 9266* (G, TYPE; NY, T, US, isotypes).

31d. Var. **saximontana**, var. nov. Herba paucicaulis; pilis minutis ramosis; caulibus 1–2 dm. altis; siliquis divaricatis obtusis; seminibus biseriatis vel uniseriatis.—Wyoming and Idaho. MAP 16. WYOMING: granitic hillsides, Porcupine Creek, near Medicine Mt., Big Horn Mts., Big Horn Co., July 6, 1936, *L. O. & R. Williams 3264* (G, TYPE; R, isotype); Piney Mt., 25 miles west of Big Piney, *E. B. & L. B. Payson 2670* (RM). IDAHO: Challis Creek, Custer Co., July, 1916, *Macbride & Payson 3319* (G, RM); Railroad Ridge, Custer Co., July, 1938, *Davis 603* (R).

Arabis microphylla is not as variable as some species of the genus and is usually readily recognized, but there are occasional specimens which show tendencies toward other species. Some collections from the Wasatch Mountains of Utah, for example, often possess the broader basal leaves of *A. Lyallii* and, unless mature fruits are present, they are difficult to place. Another instance is that of the alpine *A. nubigena* of Macbride & Payson, which I formerly treated as a variety of *A. microphylla*. The study of more material has now led me to associate this entity with *A. Lyallii*, but in many respects it is intermediate between the two species.

The stems of *A. microphylla* are slender and may be long and flexuose or short and rather rigid, depending largely upon the habitat in which the plants are growing. Ordinarily the species

¹ This same number was cited as the type of *A. elegans*, see Bot. Gaz. 33: 190 & 193 (1900).

may be found in crevices of basaltic rocks or on steep slopes in the vicinity of basaltic outcrops. *A. microphylla* follows rather closely the old Columbia River drainage and whenever it is found outside this drainage-area, marked minor differences are usually found. Thus, var. *saximontana* is partly outside the Columbia River drainage and is not associated with basaltic rocks; and var. *Macounii* is not wholly within this area. *A. microphylla* occurs most frequently in the Upper Sonoran Life Zone but penetrates well into the Canadian Life Zone at various points in its range.

Var. *Macounii* culminates a tendency toward numerous, curved, almost obliquely spreading siliques which is evident in plants from scattered stations in the range of var. *typica*. It does not have a markedly distinct geographic area which is separate at all points from that of var. *typica* but, in spite of this, it is a fairly well-marked entity on morphological grounds alone. The type of *A. densicaulis* is very similar to that of var. *Macounii* and it is evident that they should be included in a single category. It is with some hesitation that the plants here named var. *saximontana* are associated with *A. microphylla*. There is some evidence indicating that they represent a separate species, but a more thorough knowledge of their biology is needed to prove the point. The distinctive characters are the simple caudex, divaricate siliques and elliptical, imperfectly biseriolate seeds. Var. *Thompsonii* has a coarser pubescence upon the basal leaves than is found in var. *typica*, and the acuminate siliques have a definite style which approximates a millimeter in length. Otherwise, it is very much like typical *A. microphylla*.

32. *A. Fernaldiana*, sp. nov. (p. 361, FIG. 3). Herba perennis caespitosa; caulibus erectis vel basi decumbentibus inferne pubescentibus superne glabris vel pubescentibus 1.5-4 dm. altis; foliis radicalibus canescentibus integris spathulatis vel oblanceolatis petiolatis 1-4 cm. longis, 2-5 mm. latis; caulinis sessilibus auriculatis oblongis vel lanceolatis acutis 1-2 cm. longis, 2-3 mm. latis; sepalis oblongis pubescentibus 3-6 mm. longis, 1-1.5 mm. latis; petalis roseis spathulatis vel cuneatis 10-14 (5-7) mm. longis, 2.5-4 (2-3) mm. latis; pedicellis divaricatis glabris vel pubescentibus 5-10 mm. longis; siliquis erectis acuminatis glabris substipitatis 4-6 cm. longis, 1.5-2 mm. latis; stylis ca. 1 mm. longis; seminibus oblongis anguste alatis vel exalatis uniseriatis.

Perennial, caespitose; pubescence of fine dendritic trichomes; stems several to numerous from a branching caudex, erect to somewhat decumbent at base, densely pubescent below with a mixture of very fine and large trichomes or the large ones absent, pubescent or glabrous above, 1.5–4 dm. high; basal leaves numerous, entire, often clustered in sterile soboles, spatulate to oblanceolate, narrowly petiolate, densely pubescent with minute trichomes, canescent, 1–4 cm. long, 2–5 mm. wide, petioles usually ciliate with long simple or forking trichomes; cauline leaves sessile, auriculate, oblong to lanceolate, acute, densely pubescent or the upper glabrous, 1–2 cm. long, 2–3 mm. wide; inflorescence racemose, greatly elongating in fruit; sepals oblong, scarious-margined, pubescent, 3–6 mm. long, 1–1.5 mm. wide; petals pink, spatulate to cuneate, not differentiated into blade and claw, 10–14 mm. long, 2.5–4 mm. wide (5–7 mm. long, 2–3 mm. wide in var. *stylosa*); glandular tissue poorly developed, nearly surrounding single stamens, merely subtending paired stamens; filaments of paired stamens free or very rarely united; pedicels divaricate, glabrous or pubescent, 5–10 mm. long; siliques erect, acuminate, glabrous, nerveless, 4–6 cm. long, 1.5–2 mm. wide, substipitate, straight or nearly so; style about 1 mm. long; seeds oblong, narrowly winged or wingless, uniseriate, cotyledons accumbent.

Petals 10–14 mm. long; upper stems and the pedicels glabrous; basal leaves 2–4 cm. long.....Var. *typica*.
 Petals 5–7 mm. long; upper stems and the pedicels pubescent;
 basal leaves 1–2 cm. long.....Var. *stylosa*.

Var. **typica**. NEVADA: among rocks and around sagebrush, eastern slope of Toiyabe Dome, Toiyabe Mts., Nye Co., July 13, 1938, *Rollins & Chambers 2520* (G, TYPE; R, isotype); Sheep Camp Meadows, 1 mile north of Road Forks Pass, Delano Mts., eastern Elko Co., May, 1940, *Train 3706* (G, NA, R).

Var. **stylosa** (Watson), comb. nov. Perennial; stems 1–3 dm. high; basal leaves 1–2 cm. long, 2–3 mm. wide; pedicels pubescent; sepals pubescent; petals 5–7 mm. long.—*A. canescens*, var. *stylosa* Watson, Bot. Calif. 2: 431 (1880).—NEVADA: granitic soil near rocks, between Lamoille Creek and Verdi Peak, Ruby Mts., about 13 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2570* (G, R); Sherman Ridge, south end of Ruby Range, Aug., 1939, *Hitchcock & Martin 5642 & 5643* (G); E. Humboldt Mts., Aug., 1868, *Watson 70* (G, TYPE; NY, isotype).

This species, named in honor of Professor M. L. FERNALD, is nearest related to *Arabis Crandallii* and *A. microphylla*. From *A. Crandallii*, with which it agrees in pubescence, typical *A.*

Fernaldiana is distinguished by its much broader, substipitate, attenuate instead of sessile, blunt siliques; larger flowers, glabrous upper stems and pedicels, and conspicuous style. In *A. Crandallii* the sepals and petals are only about half the length of those in typical *A. Fernaldiana* and the styles are very short or obsolete. The flower-size and pubescence-distribution of *A. Fernaldiana*, var. *stylosa* are about the same as in *A. Crandallii*, but the siliques, seeds and general habit are in accord with *A. Fernaldiana*, var. *typica*.

A. Fernaldiana (both var. *typica* and var. *stylosa*) has a very fine hoary pubescence covering its basal leaves and the lower stems are appressed-pubescent with many-branched trichomes. In *A. microphylla*, the basal leaves are not hoary, the pubescence is coarser and the lower stems are hirsute with simple trichomes or rarely glabrous. The flowers are smaller and the pedicels longer in *A. microphylla* than in *A. Fernaldiana*. Unfortunately, *A. Fernaldiana*, var. *typica* is known from only two collections and var. *stylosa* from only a few. Obviously a larger series is necessary before the relationship of this species to others in the genus can be accurately established. The type of var. *typica* was collected from plants growing abundantly near the upper limit of sagebrush on the eastern slope of the Toiyabe Mountains of central Nevada. Var. *stylosa* has been found only in the Ruby Range and adjacent East Humboldt Range of the same state.

Two specimens were cited by Watson with his original diagnosis of var. *stylosa*, "Plumas County (Mrs. Austin), and East Humboldt Mountains, Nevada, Watson, n. 70". Mrs. Austin's specimen belongs to *A. Lemmoni*, hence I have designated Watson's plant as type of var. *stylosa*. Thus restricted, it is possible to keep Watson's name going, but I do not feel justified in making it the species-name.

33. *A. CRANDALLII* Robinson. Perennial; pubescence composed of minute dendritic trichomes; stems numerous from a branching, subterranean caudex, slender, erect to slightly decumbent at base, simple or rarely branched, densely pubescent or sparsely so above, 1.5-4 dm. high; basal leaves numerous, entire to obscurely dentate, oblanceolate to somewhat spatulate, usually acute, petiolate, densely pubescent, canescent, 1.5-3 cm. long, 2-4 mm. wide; cauline leaves sessile, entire, auriculate or

the auricles rarely almost obsolete, densely pubescent, canescent, oblong to lanceolate, 8–15 mm. long, 2–4 mm. wide; inflorescence racemose, elongating in fruit; sepals oblong, pubescent, scarious-margined, 3–4 mm. long, about 1.5 mm. wide, neither pair saccate; petals white to pinkish, nearly spatulate, not differentiated into blade and claw, 5–7 mm. long, 2–3 mm. wide; nectar-glands poorly developed, merely subtending all filaments; pedicels slender, erect or slightly spreading, pubescent, 5–10 mm. long; siliques erect, slender, constricted between seeds, glabrous, nerveless or faintly nerved below, obtuse, 3–6 cm. long, about 1 mm. wide; style very short or absent; seeds orbicular to slightly oblong, less than 1 mm. broad, wingless to very narrowly winged, uniseriate.—Bot. Gaz. **28**: 135 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. **227** (1909); Rydberg, Fl. Rky. Mts. **359** (1918). *A. stenoloba* Greene, Pl. Baker. **3**: 8 (1901).—MAP 17. COLORADO: Gore Canyon, Grand Co., *Osterhout 3502* (NY, RM); 3 miles north of Sargents, Gunnison Co., *Rollins 2084* (G, R); 5 miles east of Parlin, Gunnison Co., *Rollins 2091* (G, R); 6 miles east of Gunnison, *Rollins 2093* (G, R); 12 miles south of Iola, Gunnison Co., *Rollins 2019* (G, R); 1 mile east of Sapinero, *Rollins 2111* (G, R); below Sargents, Saguache Co., *Osterhout 6919* (M); Cimarron, May 18, 1898, *Crandall 6* (G, TYPE; NY, isotype), June 6, 1901, *C. F. Baker 21* (ND, TYPE; G, M, NY, RM, US, isotypes of *A. stenoloba*).

Arabis Crandallii is canescent with a very fine pubescence on the stem and foliage and is distinctive because of its very narrow, moniliform siliques. Its relatives are *A. Fernaldiana* and *A. Selbyi*. *A. Fernaldiana* is well isolated geographically, but the range of *A. Selbyi* is adjacent to that of *A. Crandallii* on the west and north. *A. Selbyi* differs from *A. Crandallii* in having broader, spreading instead of erect siliques, larger obovate to oblanceolate basal leaves and definitely winged, instead of wingless, seeds. Probably the nearest relative of *A. Crandallii* is *A. Fernaldiana*, but this relationship has been discussed under that species. *A. stenoloba* is in no way different from *A. Crandallii*. It was founded on plants collected from the type locality of *A. Crandallii* and may have been published without knowledge of the latter species which was described only two years earlier. *A. Crandallii* is very abundant on rocky hillsides and open sagebrush slopes in the Gunnison Basin of west central Colorado. It appears to be confined to the Transition Life Zone and is usually found in granitic soils. Osterhout's collection from

Grand County is from some distance north of the Gunnison Basin, but it is typical in every way. Doubtless intermediate stations will be found when the area is more thoroughly known botanically.

34. *A. Gunnisoniana*, sp. nov. (page 390, FIG. 3). Herba perennis caespitosa multicaulis; caulibus tenuibus simplicibus inferne pubescentibus superne glabratibus 1–2 dm. altis; foliis radicalibus lineari-oblongeolatis acutis integris vel sparse dentatis pubescentibus 1–2 cm. longis, 2–4 mm. latis; foliis caulinis remotis oblongis acutis 5–8 mm. longis, ca. 2 mm. latis; sepalis pubescentibus oblongis 2–3 mm. longis, ca. 1 mm. latis; petalis roseis spatulatis 4–6 mm. longis, ca. 2 mm. latis; pedicellis gracilibus divaricatis pubescentibus vel glabris 5–8 mm. longis; siliquis glabris patentibus acutis inferne 1-nervatis 2.5–4 cm. longis, 1–1.5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis ca. 1 mm. latis uniseriatis.

Caespitose perennial; stems slender, numerous from a closely branching or simple caudex, densely pubescent below, glabrate above, simple, 1–2 dm. high; basal leaves numerous, linear-oblongeolate, acute, entire or rarely few-toothed 1–2 cm. long, 2–4 mm. wide, densely pubescent with medium-sized dendritic trichomes; cauline leaves few, remote, pubescent or the upper glabrate, oblong, acute, 5–8 mm. long, about 2 mm. wide, auriculate but the auricle small; sepals oblong, 2–3 mm. long, about 1 mm. wide; petals spatulate, pink to purplish, 4–6 mm. long, about 2 mm. wide; glandular tissue weakly developed, in a continuous mold under all stamens; pedicels widely spreading at right angles to rachis, straight to slightly curved downward, pubescent or rarely completely glabrous, slender, 5–8 mm. long; siliques glabrous, spreading at right angles to stem or slightly descending, straight to slightly curved, acute, nerved nearly to the middle, 2.5–4 cm. long, 1–1.5 mm. wide; stigma sessile; seeds orbicular, narrowly winged, about 1 mm. broad, uniseriate.—COLORADO: Gunnison Co.: barren rocky knoll near Saguache Creek, 6 miles east of Gunnison, May 21, 1938, *Rollins 2090* (G, TYPE; R, isotype); 4 miles east of Gunnison, May, 1938, *Rollins 2096* (G, R); 4 miles south of Tomichi Creek, about 10 miles southeast of Gunnison, Sept., 1937, *Rollins 2014* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2114* (G).

While botanizing in the Gunnison Basin in the fall season of 1937, I discovered the basal leaves and old stems of an *Arabis* which was unfamiliar to me. Returning to the same locality the following spring, I found abundant material of the plant described above. *A. Gunnisoniana* is probably most closely



FIG. 1. *A. CRANDALLII* drawn from *Rollins 2091*; FIG. 2. *A. LIGNIFERA* drawn from *Rollins 2274*. Both figures about one-half natural size.

related to *A. Selbyi*, from which it differs in its smaller stature, smaller leaves, more numerous slender stems and narrower siliques. In habit our plant more closely resembles *A. demissa*. However, the pubescence and seeds of *A. demissa* and *A. Gunnisoniana* are entirely different. The species is named for J. W. GUNNISON whose name designates the area in which it is abundant.

35. *A. SELBYI* Rydberg. Perennial; stems several to numerous from a simple or usually much branched caudex, usually branched above, erect or ascending, often decumbent at base, slender to fairly stout, pubescent below with dendritic or rarely forked trichomes, usually glabrous above, 2.5–5 dm. high; basal leaves numerous, oblanceolate to broadly spatulate, obtuse to nearly acute, entire or dentate, densely to sparsely pubescent with fine dendritic trichomes, grayish, 3–7 cm. long, 6–20 mm. wide; cauline leaves few, sessile, remote, linear-oblong to lanceolate, entire, auriculate, 2–5 mm. wide, 1–3 (–4) cm. long, lower pubescent, upper glabrous; sepals oblong, non-saccate, 3–4 mm. long, 1.5–2 mm. wide, pubescent; petals pink, spatulate to narrower, 6–8 mm. long, 1.5–2.5 mm. wide; glandular tissue poorly developed, continuous beneath all stamens; fruiting pedicels divaricately ascending or spreading at right angles to rachis, glabrous to sparsely pubescent, straight or nearly so, 5–12 mm. long; siliques slightly curved to straight, rarely nearly arcuate, divaricately ascending to spreading at right angles, glabrous, 3–6 cm. long, 1.5–2 mm. wide; valves faintly nerved at base to nerveless, often somewhat constricted between seeds; stigma sessile; seeds orbicular, narrowly winged, 1–1.5 mm. broad, uniseriate.—Bull. Torr. Bot. Club **31**: 557 (1904); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 361 (1918).—Western Colorado to Utah and northwestern New Mexico. MAP 15. COLORADO: 5 miles west of Walden, Jackson Co., Aug., 1937, *Beetle 2350* (R) ?, only basal leaves and old stalks present; State Bridge, Eagle Co., May, 1910, *Osterhout 4215* (NY); Glenwood Springs, Garfield Co., June, 1902, *Osterhout 2576* (RM); 10 miles north of Mesa, Mesa Co., May, 1938, *Rollins 2191* (G, R); 8 miles west of Grand Junction, Mesa Co., May, 1938, *Rollins 2160 & 2170* (G, R); Grand Junction, June, 1915, *Macbride & Payson 714* (RM); tributary of Little Dolores River, 7 miles west of Glade Park, Mesa Co., Aug., 1937, *Rollins 1898* (R); 1 mile south of Gateway, Mesa Co., Aug., 1937, *Rollins 1910* (R); Paonia, Delta Co., May, 1911, *Osterhout 4513* (NY); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2122* (G, R); near Bostwick Park, Montrose Co., Aug., 1937, *Rollins 1984* (R); west of Ouray, Ouray Co., Sept. 9, 1901, *Underwood*

& *Selby* 207 (NY, TYPE); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Aztec, May, 1899, *Baker* 343 (G). UTAH: 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins* 1753a (DS, G); La Sal Mts., June, 1914, *M. E. Jones s.n.* (P); Red Canyon, near Bryce Canyon, Garfield Co., June, 1933, *Eastwood & Howell* 667 (G).

The type of *A. Selbyi* is a slightly aberrant specimen when compared with plants from the type-locality placed in this species. The stems of the type are unusually elongated, as is the infructescence, and the pedicels diverge from the rachis at right angles, instead of being divaricately ascending as is usually the case. These peculiarities may be due to the fact that the type is a post-season plant, collected in September, instead of May or June, or perhaps it came from an unusual habitat. In August and September of 1937 and again in late May, 1938, I searched the general area where the type of *A. Selbyi* was collected, but no plants which exactly duplicate it were found. In the fall of 1937 basal leaves and old fruiting stalks were found at several stations, but these are like the plants collected in the spring of the following year. Further exploration of western Colorado may show that the type of *A. Selbyi* really represents a natural entity. If such is proved to be the case, then all the collections cited above, except the type, should be placed in a separate variety.

A. Selbyi is very closely related to *A. lignifera*. The differences between the two are pointed out in a discussion under the latter species. Obviously, the entire range of *A. Selbyi* is not known, and one cannot be certain that these two closely related plants will be kept as separate species if an intergrading series of forms is discovered. At present it seems best to treat them as distinct species.

36. *A. LIGNIFERA* A. Nelson. Perennial; stems one or usually few from a simple or branched caudex, erect, simple or usually branched above, densely pubescent below with appressed minute stellate trichomes, glabrous above, 2-5 dm. high; basal leaves linear-oblongate, acute to obtuse, entire, densely pubescent with minute dendritic trichomes, petiolate, 2-5 cm. long, 3-8 mm. wide; cauline leaves oblong, auriculate, entire, remote to sub-remote, 1-3 cm. long, 2-5 mm. wide, lower densely pubescent, upper sparsely pubescent to glabrous; inflorescence loosely racemose; sepals oblong, pubescent, purplish, 3-4.5 mm. long,

about 1.5 mm. wide, non-saccate; petals pink to purplish, spatulate to lingulate, 5–8 mm. long, 1.5–2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels sparsely pubescent to glabrous, arched downward, 5–12 mm. long; fruiting raceme lax; siliques laxly pendulous, not crowded, curved inward or rarely almost straight, glabrous or very rarely sparsely pubescent, 3–6 cm. long, 1.5–2 mm. wide, valves one-nerved to the middle or above; style very short or obsolete; seeds orbicular to slightly oblong, narrowly winged, 1–1.2 mm. broad, uniseriate to imperfectly biseriate, cotyledons accumbent.—Bull. Torr. Bot. Club **24**: 123 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. **229** (1909); Rydberg, Fl. Rky. Mts. **362** (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25**: 245 (1925).—Wyoming and Idaho to Arizona and Nevada. MAP 2. WYOMING: 20 miles north of Baggs, Carbon Co., May, 1938, *Rollins 2211* (G, R); Green River, Sweetwater Co., June, 1898, *Nelson 4711* (RM, TYPE; G, M, isotypes); 2 miles southeast of Green River, June, 1938, *Rollins 2246* (G, R); rocky hillside, near Lyman, Uinta Co., June, 1937, *Rollins 1614* (DS, G, R), June, 1938, *Rollins 2308* (G, R); 3 miles south of Lone-tree, June, 1938, *Rollins 2304* (G, R); Flat Iron Butte, west of Cumberland, Lincoln Co., June, 1938, *Rollins 2359* (G, R). COLORADO: Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, M); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2129* (G, R); near Meeker, Rio Blanco Co., May, 1938, *Rollins 2222* (G, R); Disappointment Ranger Station, Dolores Co., May, 1914, *Wilson 711* (FS). NEVADA: 7 miles northwest of Ragsdale Springs, White Pine Co., May, 1937, *Moore & Franklin 165* (R); 15 miles west of McGill, White Pine Co., May, 1937, *Moore & Franklin 229* (R); near South Twin Creek, eastern base of Toiyabe Dome, Nye Co., July, 1938, *Rollins & Chambers 2519* (G); 20 miles east of Battle Mt., June, 1933, *Eastwood & Howell 178* (G); Empire City, June, 1882, *Jones 3763* (P). IDAHO: Beaver Canyon, June, 1895, *Shear 3064* (M); Shoupe, Lemhi Co., June, 1938, *Davis 417* (UIP); Big Creek, Butte Co., May, 1938, *Davis 182* (UIP). UTAH: Gold Hill, Tooele Co., June, 1917, *M. E. Jones s.n.* (P); Deep Creek, Tooele Co., June, 1891, *M. E. Jones s.n.* (P); Clifton, Tooele Co., May, 1917, *M. E. Jones s.n.* (P); Alta, Salt Lake Co., July, 1910, *M. E. Jones s.n.* (P); Stansbury Island, Great Salt Lake, June, 1869, *Watson 76* (G); 15 miles southeast of Manila, Daggett Co., June, 1938, *Rollins 2274* (G, R); 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1753* (G, R); Mammoth, Juab Co., May, 1910, *M. E. Jones s.n.* (P); Scofield, Carbon Co., June, 1904, *M. E. Jones s.n.* (P); Cedar City, Iron Co., May, 1894, *Jones 5204ad* (P). ARIZONA: 12 miles east of

Keams Canyon, Navajo Co., June, 1937, *Peebles & Smith 13438* (G, Sac).

Arabis lignifera is closely related to *A. Selbyi* and *A. Holboellii*, var. *retrofracta*. From the latter, it is distinguished by having loosely pendulous and curved, instead of strictly reflexed, straight siliques. Also, *A. lignifera* has smaller, more remote cauline leaves and smaller flowers than *A. Holboellii*, var. *retrofracta*. In general appearance, *A. lignifera* resembles *A. Selbyi* more than any other, but the two species differ in a number of technical points and apparently occupy separate geographical areas. The pedicels and siliques are divaricate to ascending and nearly straight in *A. Selbyi*, whereas in *A. lignifera* the pedicels arch downward with the pendulous siliques curved inward. The basal leaves of *A. Selbyi* are broadly oblanceolate to obovate and often repand or dentate, while in *A. lignifera* they are linear-oblanceolate and entire. The valves of the siliques in *A. lignifera* are strongly nerved to the middle or above, but in *A. Selbyi* the valves are plain or very faintly nerved at the extreme base. *A. lignifera* occurs in the upper Sonoran Life Zone and is usually associated with sagebrush, juniper or similar desert plants.

37. *A. HOLBOELLII* Hornem. Biennial or perennial; stems one to several from a simple or branching caudex, simple or branched above, erect, pubescent throughout with appressed or spreading trichomes to glabrous above, 1–9 dm. high; basal leaves linear-oblanceolate to broadly spatulate, entire to somewhat dentate, densely pubescent with fine to coarse dendritic trichomes, often pannose, acute to obtuse, 1–5 cm. long, 1.5–6 (–8) mm. broad; cauline leaves auriculate and clasping to non-auriculate, with a narrowed base, entire, oblong to lanceolate, 1–4 cm. long, 1.5–6 mm. wide, lower densely pubescent, upper pubescent to glabrous; inflorescence loosely racemose; sepals oblong, scarious-margined, pubescent or glabrous, 2–4 (–5) mm. long, 1–2 mm. wide; petals spatulate with a narrow claw, purplish pink to whitish, (5–) 6–10 mm. long, 2–3.5 mm. wide; fruiting pedicels straight to somewhat curved, often geniculate, strictly reflexed to loosely descending, pubescent or glabrous, slender, 6–16 mm. long; siliques glabrous (sometimes pubescent in var. *retrofracta*), straight to slightly curved, strictly reflexed to loosely pendulous, nerved below or to slightly above middle, obtuse to acute, 3–7 cm. long, 1–2.5 mm. wide; seeds orbicular, narrowly winged all around, about 1 mm. broad, uniseriate or imperfectly biseriate.

KEY TO THE VARIETIES OF *A. HOLBOELLII*

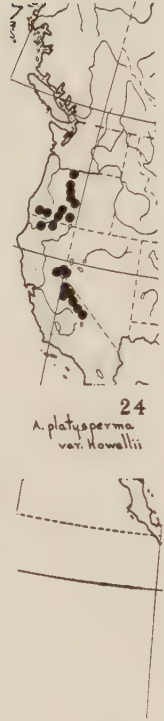
- a. Cauline leaves auriculate; plants usually more than 2 dm. high; basal leaves mostly more than 3 mm. broad. . . . b.
- b. Pedicels geniculate near base, usually straight or at least not uniformly curved; siliques strictly reflexed to somewhat spreading, but not loosely pendulous, straight or nearly so; pubescence of basal leaves fine. c.
- c. Lower stem hirsutulous with large spreading hairs; petals 5-7 mm. long. 37c. var. *Collinsii*.
- c. Lower stem appressed-pubescent with small or minute hairs; petals 7-10 mm. long. d.
- d. Cauline leaves usually flat, upper glabrous; siliques 2-2.5 mm. wide; mature basal leaves evenly pubescent with spaced trichomes. 37a. var. *typica*.
- d. Cauline leaves usually revolute, upper finely pubescent; siliques 1-2 mm. wide; basal leaves densely pubescent, very often pannose. . . . 37b. var. *retrofracta*.
- b. Pedicels gently curved downward; pods pendulous, usually somewhat curved inward; pubescence of basal leaves coarse. 37e. var. *pinetorum*.
- a. Cauline leaves lacking auricles; plants usually less than 2 dm. high; basal leaves less than 3 mm. broad. . 37d. var. *pendulocarpa*.

37a. Var. **typica**. *A. Holboellii* Hornem., Fl. Dan. 11: 5, t. 1879 (1827); Lange, Consp. Fl. Groenl. 49 (1880); Watson in Gray, Syn. Fl. N. Am. 1: 164 (1895) in part; Henry, Fl. So. Brit. Columb. 149 (1918) in part; Rollins in Res. Stud. State Coll. Wash. 4: 27 (1936); Hopkins in RHODORA 39: 170 (1937) in large part. *Erysimum Holboellii* (Hornem.) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891), as "*Holboellii*". *A. holboellii patula* sensu Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) 11: 293 (1906). *A. retrofracta* sensu G. N. Jones in Univ. Wash. Pub. Biol. 7: 91 (1939).—Greenland,¹ Quebec, Alberta, Yukon, British Columbia and Washington. MAP 20. ALBERTA: Banff, June, 1906, *S. Brown* 111 (G). WASHINGTON: Nisqually River, Mt. Rainier Nat. Park, July, 1937, *G. N. Jones* 10274 (G); Nisqually Checking Station, Mt. Rainier Nat. Park, July, 1922, *Abrams* 9215 (M, P, RM); moraine of Emmons Glacier, Mt. Rainier, June, 1937, *G. N. Jones* 9997 (G); Mt. Rainier Nat. Park, June, 1936, *L. S. Rose* 36378 (R); Green River Hot Springs, July, 1888, *Piper* 544 (G, WSC); Mt. Angeles, Clallam Co., July, 1931, *Thompson* 7427 (M, NY), June, 1934, *Thompson* 10603 (M), July, 1931, *J. T. Howell* 7454 (G); on low ground in valleys, Skamania Co., July, 1894, *Suksdorf* 2354 (G, WSC); headwaters of Robinson Cr., Okanogan Co., July, 1916, *Eggleston* 13203 (US); Barnard Trail, Tiffany Mt., July, 1932, *Fiker* 1002 (T, WSC). BRITISH COLUMBIA: Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson* 87 (G); Mt. Selwyn, July,

¹ For specimens cited from east of the one hundredth meridian, see Hopkins, op. cit. p. 171. These are *A. Holboellii*, var. *typica* with the exception of *Stebbins* 798 from Quebec, which is var. *retrofracta*, and the Michigan specimens which are *A. divaricarpa* A. Nels.

1932, *Raup & Abbe 3958* (G). YUKON: Dawson, June, 1914, *Eastwood 134* (Cl, G, in part). ALASKA: Lower Tanana River, May 27, 1936, *Murie s.n.* (L).

37b. Var. *RETROFRACTA* (Graham) Rydberg. Stems densely pubescent with fine appressed dendritic trichomes to glabrous above; basal leaves pannose to subpannose, usually entire; cauline leaves revolute-margined; pedicels pubescent, strongly reflexed, usually geniculate; petals usually whitish, but often pink; siliques glabrous or sometimes finely pubescent, strongly reflexed, usually appressed to rachis, straight or nearly so, 3.5–8 cm. long, 1–1.5 mm. wide.—Contrib. U. S. Nat. Herb. **3**: 484 (1896); Jepson, Man. Fl. Pl. Calif. **429** (1925) in part. *A. retrofracta* Graham in Edinb. New Phil. Journ. **344** (1829); Watson in King, Geol. Expl. Fortieth Parallel **5**: 18 (1871) in part; Greene, Pitt. **4**: 188 (1900); Rydberg, Fl. Rky. Mts. **362** (1918) in part, and Fl. Pr. Pl. Cent. N. Am. **382** (1932) in part; Jepson, Flora Calif. **2**: 67 (1936) in part; Hopkins in RHODORA **39**: 179 (1937). *Streptanthus virgatus* Nuttall in T. & G., Fl. N. Am., **1**: 76 (1838). *A. Holboellii* sensu Brewer & Wats., Bot. Calif. **1**: 33 (1876); Watson in Gray, Syn. Fl. N. Am. **1**: 164 (1895) in part; Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) **11**: 293 (1906). *A. secunda* Howell in Erythea **3**: 33 (1895); Jepson, Flora Calif. **2**: 66 (1936). *A. arcuata* Gray, var. *secunda* (Howell) Robinson in Gray, Syn. Fl. N. Am. **1**: 164 (1895). *A. sparsiflora secunda* (Howell) Piper, op. cit. p. 294. *A. Holboellii* Hornem., var. *secunda* (Howell) Jepson, Man. Fl. Pl. Calif. **430** (1925). *A. rhodantha* Greene, Pitt. **3**: 155 (1897); Rydberg, Fl. Colo. **165** (1906) and Fl. Rky. Mts. **362** (1918); Coulter & Nelson, New Man. Bot. Rky. Mts. **228** (1909). *A. exilis* A. Nelson in Bull. Torr. Bot. Club **26**: 123 (1899); Coulter & Nelson, l. c.; Rydberg, Fl. Rky. Mts. **363** (1918). *A. tenuis* Greene, Pitt. **4**: 189 (1900). *A. lignipes* A. Nelson in Bot. Gaz. **30**: 191 (1900); Coulter & Nelson, op. cit. p. 229; Rydberg, Fl. Rky. Mts. **362** (1918). *A. consanguinea* Greene, Pitt. **4**: 190 (1900); Rydberg, Fl. Colo. **165** (1906) and Fl. Rky. Mts. **362** (1918). *A. Kochii* Blankinship in Mont. Agri. Coll. Sci. Stud. **1**: 57 (1904), not Jordan, Diag. **1**: 112 (1864). *A. caduca* A. Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. **229** (1909); Rydberg, Fl. Rky. Mts. **363** (1918). *A. polyantha* Greene, Leaflets **2**: 80 (1910). *A. MacDougalii* Rydberg in Bull. Torr. Bot. Club **39**: 326 (1912). *Turritis retrofracta* (Grah.) Hooker, Fl. Bor.-Am. **1**: 41 (1829). *Sisymbrium pauciflorum* Nuttall ex T. & G., Fl. N. Am. **1**: 93 (1838).—Locally in Quebec and Michigan, more abundant westward from Saskatchewan and Alberta to Colorado, California, Washington, British Columbia and north to Yukon. MAP 21. PRECISE



LOCALITY UNKNOWN: Rocky Mountains (of Canada), Palliser's Brit. N. Am. Expl. Exped., 1858, *E. Bourgeau s.n.* (G, PROVISIONAL TYPE). SASKATCHEWAN: junction of north fork and north branch of the Saskatchewan River, June, 1908, *Brown 924* (G); vicinity of Cornwall Bay, Lake Athabaska, July, 1935, *Raup 6446* (G); Charlot Point, Lake Athabaska, June, 1935, *Raup 6081* (G). ALBERTA: Bow River Valley, vicinity of Banff, June, 1906, *Brown 50* (G); Laggan, Rky. Mt. Park, June, 1904, *Macoun s.n.* (G); Banff, July, 1907, *Butters & Holway 52* (G); Crow Nest Pass, Aug., 1897, *Macoun 18109* (G); Pine Lake district, Wood Buffalo Park, July, 1928, *Raup 2491* (G, Can); Peace Point, Wood Buffalo Park, July, 1928, *Raup 2490* (G). MONTANA: Bozeman, June, 1906, *Blankinship 554a* (P); Cache Creek, Mineral Co., July, 1933, *C. L. Hitchcock 1754* (G); Wild Horse Island, Flathead Lake, Aug., 1908, *M. E. Jones 8026* (P); near Missoula, June, 1901, *MacDougal 191* (NY, TYPE; US, isotype of *A. MacDougalii* Rydb.; May, 1933, *C. L. Hitchcock 1632* (G); Mud Lake, Ravalli Co., Aug., 1933, *C. L. Hitchcock 2075* (G); near Pony, Madison Co., July, 1897, *Rydberg & Bessey 4227* (G, NY). WYOMING: on high hills, sources of the Sweetwater, *Nuttall s.n.* (photo of the type of *Streptanthus virgatus* in Gray Herb.); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2859* (G, R); Madison River, Yellowstone Nat. Park, June, 1899, *A. & E. Nelson 5505* (RM, TYPE; G, isotype of *A. lignipes*); 10–15 miles east of Kane, Big Horn Co., June, 1936, *L. O. & R. Williams 3013* (R); near Fremont Lake, Sublette Co., Sept., 1935, *Ownbey 1008* (R); Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3401* (G, RM); Evanston, June, 1898, *A. Nelson 4523* (RM, TYPE; G, isotype of *A. exilis*); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2067* (G, R); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1657* (G, R); Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1070* (DS, G, R); Woods Creek, Aug. 11, 1896, *A. Nelson 2584* (RM, TYPE of *A. caduca*). COLORADO: 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2188* (G, R); 2 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2146* (G, R); 5 miles north of Grand Lake, Grand Co., July, 1935, *Rollins 1018* (DS, G, R); 3 miles south of Milner's Pass, Rky. Mt. Nat. Park, June, 1938, *Rollins & Chambers 2402* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1425* (DS, G, R); near Empire, 1875, *E. L. Greene s.n.* (ND, TYPE of *A. rhodantha*; photo in Gray Herb.); Los Pinos (Bayfield), May 18, 1899, *Baker s.n.* (ND, TYPE; RM, UC, isotypes of *A. consanguinea*; photo in Gray Herb.); near Sargent's, Saguache Co., May, 1938, *Rollins 2087* (G, R). IDAHO: forks of St. Marys River, July, 1895, *Leiberg 1161* (G); ridges

south from Weissners Peak, July, 1895, *Leiberg 1404* (G, M, O, P); east of Laird Park, Latah Co., May, 1936, *Rollins & Constance 1108* (G, R, WSC); near Pollock, Idaho Co., May, 1937, *Constance 1854* (G, R); Cuddy Mts., Washington Co., July, 1899, *M. E. Jones* (M, P); Idaho Falls, May, 1924, *Nelson 10051* (RM, UAC); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3271* (G, P); Elgin, Fremont Co., May, 1919, *Quayle 38* (P); Thunderbolt Mt., Valley Co., July, 1937, *Thompson 13920* (R); Silver City, Owyhee Co., June, 1911, *Macbride 1011* (RM, US). UTAH: Tony Grove Canyon, Cache Co., July, 1936, *Maguire et al. 13959* (UAC); Providence Bench and Providence Canyon, Cache Co., May, 1932, *Maguire 3444 & 3443* (UAC); Salina Canyon, June, 1894, *M. E. Jones s.n.* (P); Lake Point, May, 1880, *M. E. Jones s.n.* (P); Salt Lake Co., June, 1905, *Garrett 1094* (G); Coalville, May, 1889, *M. E. Jones s.n.* (P); 25 miles south of Manila, Uintah Co., June, 1937, *Rollins 1765* (DS, G, R); 12 miles south of Manila, Daggett Co., June, 1938, *Rollins 2268* (G, R); Trout Creek, Juab Co., *Maguire & Becraft 2626* (UAC). NEVADA: Jarbidge, July, 1912, *Nelson & Macbride 1920* (G); July, 1938, *Rollins & Chambers 2579* (G, R); Star Peak, Pershing Co., July, 1901, *M. E. Jones s.n.* (P); about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2548* (G, R); Coleman Pass Canyon, northwestern Washoe Co., June, 1939, *Train 2983* (NA, R); Palisade, June, 1882, *M. E. Jones s.n.* (P); King's Canyon, Ormsby Co., June, 1902, *Baker 891* (G); Sweetwater Mts., near Sweetwater, Mineral Co., July, 1919, *Tidestrom 10204* (G); near Lehman Cr., east of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2470* (G, R). CALIFORNIA: near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13203* (G, R); Loy Lake, Siskiyou Co., July, 1910, *Butler 1663 & 1763* (P); Salmon Summit, Humboldt Co., July, 1935, *Tracy 14379* (UC); Rae Lake, Fresno Co., July, 1910, *Mrs. Joseph Clements s.n.* (P); Rock Creek Lake Basin, Inyo Co., Aug., 1937, *Peirson 12183* (Peirs); above Lake Sabrina at the head of Bishop Creek, Aug., 1938, *Constance 2463* (R, UC); Sierra City, Sierra Co., June, 1938, *Constance 2296* (R, UC); lower end of Donner Lake, Nevada Co., July, 1903, *Heller s.n.* (G); Deer Park, Lake Tahoe region, June, 1912, *Eastwood 368* (Cl, G); Baldwin Lake, San Bernardino Co., May, 1932, *Peirson 9966* (Peirs). OREGON: McKenzie Highway, Lane Co., April, 1934, *Eastwood & Howell 1625* (G); Swan Valley, Klamath Co., June, 1896, *Applegate 29* (G); Abbott Butte, Jackson Co., July, 1936, *Thompson 13055* (G, R); Wallowa Lake, Wallowa Co., Aug., 1935, *Constance & Jacobs 1315* (UC, US, WSC); near Anthony Lake, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2599* (G); Powder River Mts., Aug., 1896,

Piper 2504 (G, WSC); Blue Mts., Grant Co., June, 1925, *Henderson 5290* (US). WASHINGTON: Malden-Pine City, Whitman Co., May, 1936, *Rollins & Constance 1092* (G, R); near Spokane Bridge, Spokane Co., May and July, 1916, *Suksdorf 8567* (G, R, UC, US, WSC); near Caisy, Stevens Co., May, 1937, *Constance 1841* (G, R); Kettle Falls, Ferry Co., May, 1937, *Constance 1842* (G, R); Metaline, Pend Oreille Co., June, 1933, *Thompson 9224* (G); Godman Springs, Columbia Co., July, 1935, *Constance et al. 1191* (WSC); Barron, Whatcom Co., Aug., 1937, *Muenschner 7882* (G); Mt. Adams, Aug., 1882, *Howell 1487* (O, TYPE; NY, UC, US, WSC, isotypes of *A. secunda* Howell); Rock Island, Chelan Co., April, 1899, *Whited 1043* (US, TYPE; OS, WSC, isotypes of *A. polyantha* Greene); on mountains, w. Klickitat Co., May, 1884, and July, 1885, *Suksdorf 15* (ND, TYPE; G, R, isotypes of *A. tenuis* Greene). BRITISH COLUMBIA: Peace River at Taylor Flat, June, 1932, *Raup & Abbe 3573* (G); shore of Howser Lake, June, 1905, *Shaw 711* (G); Kicking Horse Valley, vicinity of Field, June, 1906, *Brown 351* (G); five miles north of Birch Island, North Thompson River, May, 1935, *McCabe 1891* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M. Thompson 319* (G); south of Kamloops, May, 1938, *J. W. & E. M. Thompson 41* (G); Cranbrook, May, 1930, *Grove s.n.* (G). YUKON: White Horse, Sept. 2, 1902, *Macoun* (Can. 54359); Hunker Creek, July 31, 1902, *Macoun* (Can. 58357); Lake Bennett, July 8, 1902, *Macoun* (Can. 58356); White Horse Rapids, *Tarleton 30* (NY); Klondike-Dawson, July 11, 1902, *Macoun* (Can. 58355).

37c. Var. ***Collinsii*** (Fernald), comb. nov. Stems 2–6 dm. high, hirsutulous below with coarse spreading simple or branched trichomes, glabrous above; cauline leaves auriculate at base, lower finely pubescent, upper glabrate; pedicels strongly reflexed, geniculate, sparsely pubescent to glabrous; petals white to pinkish, 6–8 mm. long, 2–3 mm. broad; siliques glabrous, straight, nerved to middle or slightly beyond, usually strictly reflexed.—*A. Collinsii* Fernald in RHODORA 7: 32 (1905); Britton & Brown, Ill. Fl. 2: ed. 2, 183, fig. 2082 (1913); Marie-Victorin, Fl. Laurent. 261 (1935). *A. pendulocarpa* sensu Hopkins in RHODORA 39: 183 (1937) in part.—Rimouski County, Quebec;¹ Manitoba, Alberta, South Dakota, Montana and Wyoming. MAP 22. MANITOBA: north of Carberry, June, 1906, *Macoun & Herriot 69860* (G). ALBERTA: vicinity of Rosedale, April, 1915, *Moodie 823* (G, NY); near Banff, July, 1931, *Pease 22441* (G). SOUTH DAKOTA: Custer Peak, Lawrence Co., June, 1929, *Palmer 37545* (G); near Savoy, June, 1910, *J. Murdoch, Jr. 4116* (G). MONTANA: near Missoula, June, 1918, *Collins s.n.* (G),

¹ For citations of specimens from Quebec, see Hopkins, op. cit. p. 184 under *A. pendulocarpa* A. Nels.

July, 1933, *C. L. Hitchcock 1839* (G, R); above Bonner, Missoula Co., July, 1933, *C. L. Hitchcock 1686* (G); 30 miles south of Missoula, Ravalli Co., May, 1933, *C. L. Hitchcock 1569* (G) in part; Spanish Creek, Gallatin Co., May, 1901, *J. Vogel s.n.* (G) in part; Bridger Pass, Gallatin Co., Aug., 1916, *Suksdorf 53* (G); Westby, Sheridan Co., June, 1927, *Esther Larsen 21* (G); 17 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2830* (G, R). WYOMING: near Hulett, Crook Co., May & June, 1935, *Ownbey 532, 532a, 545*, in flower; *545a, 532b* in fruit (R), May, 1935, *Ownbey 551a* (G); Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5728* (RM).

37d. Var. **pendulocarpa** (A. Nels.), comb. nov. Stems slender, usually simple, pubescent below with coarse simple or branched, often spreading trichomes, glabrous above, 1–2.5 dm. high; cauline leaves acute, not auriculate at base; basal leaves entire; pedicels arched downward, not strictly reflexed nor straight; siliques pendulous, straight or very slightly curved inward.—*A. pendulocarpa* A. Nelson in Bot. Gaz. **30**: 192 (1900); Rydberg, Fl. Rky. Mts. 363 (1918); Hopkins in RHODORA **39**: 183 (1937) in part. *A. canescens* sensu Rollins in Res. Stud. State Coll. Wash. **4**: 35, fig. 9 (1936).—Montana to Colorado, California and British Columbia. MAP 22. MONTANA: Missoula, April, 1921, *Kirkwood 1133* (Cl, NY), March and April, 1915, *Kittredge s.n.* (G), May, 1933, *C. L. Hitchcock 1592* (G, P, RM); 5 miles east of Perma, May, 1933, *C. L. Hitchcock 1551* (G, P, R, RM); 12 miles west of Wilsall, Park Co., July, 1921, *Suksdorf 352* (R). WYOMING: Yellowstone Nat. Park, Aug. 1922, *E. B. & L. B. Payson 3105* (RM), May, 1902, *Mearns 753* (US); Madison River, Y. N. Park, June, 1899, *A. & E. Nelson 5504* (RM, TYPE; G, NY, US, isotypes); Piney Mt., Sublette Co., July, 1922, *E. B. & L. B. Payson 2678* (G, NY, RM, US); Gros Ventre Fork (Snake R.) June, 1860, *Heyden 71* (M); Sheep Mt., Lincoln Co., July, 1923, *Payson & Armstrong 3446* in part (G, RM); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2047* (G, R); 6 miles west of Jackson, Teton Co., June, 1936, *L. O. & R. Williams 3008b* (R). COLORADO: near Kings Canyon, Jackson Co., June, 1925, *E. B. & L. B. Payson 4252* (RM). IDAHO: Henry Lake, July, 1920, *E. B. & L. B. Payson 1971* (G, NY, RM); Mt. Borah, near Chilly, Custer Co., June, 1939, *Christ & Ward 10643* (Herb. J. H. Christ); forks of Big Creek, Custer Co., May, 1932, *A. M. Cusick 163* (FS); Gallagher Canyon, Lemhi Forest, May, 1928, *Schulze 47* (FS); south end of Soldier Mts., Blaine Co., June, 1916, *Macbride & Payson 2898* in part (G, RM, UC, US). CALIFORNIA: Warren Peak, head of Parker Creek, Modoc Co., July, 1917, *Smith 55* (FS); one-

half mile southeast of King's Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5322* (G, R). OREGON: Strawberry Butte, Blue Mts., July, 1896, *Coville 552* (US). WASHINGTON: Beehive-Cashmere Trail, Wenatchee Forest, May, 1925, *Ingram 1956* and *1960* (FS, OS); Summit of Bald Mt., Valley of Nile Creek, Rainier Nat. Forest, Yakima Co., July, 1923, *St. John 7856* (WSC); Mt. Adams, July, 1906, *Suksdorf 5751* (WSC); Hurricane Ridge, Clallam Co., July, 1933, *G. N. Jones 4017* (UW); July, 1931, *G. N. Jones 3406* and *3201* (UW); Mt. Angeles, July, 1931, *G. N. Jones 3322* (UW). BRITISH COLUMBIA: Midway, April, 1905, *Spreadborough 70817* (G, NY); Yale, May, 1889, *J. Macoun s.n.* (G); Carbonate Draw, July, 1904, *Hescock 3091* (G); Penticton, April, 1903, *Spreadborough 59558* (G, NY); near Lake Boothanie, Marble Mts., June, 1938, *J. W. & E. Thompson 155* (G).

37e. Var. **pinetorum** (Tidestrom), comb. nov. Stems hirsutulous below with simple, branched or dendritic trichomes, glabrous above, 3–9 dm. high; basal leaves broadly oblanceolate to more narrowly so, densely pubescent with coarse dendritic trichomes; pedicels usually slightly arched downward, rarely geniculate, usually glabrous; siliques slightly curved inward, sometimes straight, glabrous, 4–7 cm. long, 1.5–2 mm. wide.—*A. pinetorum* Tidestrom in Proc. Biol. Soc. Wash. **36**: 182 (1923) and Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25**: 245 (1925). *A. Holboellii*, var. *retrofracta* sensu Munz, Man. So. Calif. Bot. **205** (1935). *A. retrofracta* sensu Jepson, Fl. Calif. **2**: 67 (1936) in part.—Southern Saskatchewan, Nebraska and Colorado to California and British Columbia. MAP 20. SASKATCHEWAN: Wood Mountain Post, June, 1895, *Macoun 5933* (P). NEBRASKA: Ft. Robinson, June, 1890, *J. M. Bates s.n.* (G). WYOMING: Plumbago Canyon, Albany Co., June, 1930, *Nelson 11307* (G, RM); Laramie Hills, May, 1896, *Nelson 1885* (G). COLORADO: South Park, 1873, *Wolf & Rothrock 655* (G); Alvarado Ranger Station, Custer Co., June, 1936, *Rollins 1246* (G, R); La Veta Pass, Costella Co., June, 1936, *Rollins 1288a* (G, R); 10 miles east of Leadville, Lake Co., July, 1936, *Rollins 1349* (G, R); Monarch Pass, Chaffee Co., July, 1936, *Rollins 1343a* (R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426* (DS, G, R); 6 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2095* (G, R). IDAHO: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1788* (G); Silver City, Owyhee Co., June, 1911, *Macbride 934* (G). UTAH: Providence Canyon, Cache Co., May, 1933, *Muenschner & Maguire 2346* (UAC); Wasatch Mts., May, 1867, *Bailey 76* (G); Summit Springs Ranger Station, Daggett Co., June, 1932, *L. O. Williams 567* (G); Fish Lake, Aug., 1894, *Jones 5770a* (P); Marysville,

June, 1894, *Jones 5353* (P). NEVADA: Duck Creek, Shell Creek Mts., July, 1924, *Jones s.n.* (P), Aug., 1880, *Jones s.n.* (P); 2 miles south of Lehman Creek, near base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2485* (G, R); west slope of Pioche Mt., Lincoln Co., April, 1939, *Train 2666* (NA, R); 12 miles north of Pioche, Lincoln Co., May, 1939, *Train 2676* (G); Glenbrook, Lake Tahoe, July 7, 1919, *Tidestrom 10387* (US, TYPE), July 6, 1919, *Tidestrom 10279* (G). CALIFORNIA: near Etna, Siskiyou Co., June, 1937, *Eastwood & Howell 5031* (R); One Thousand Lake Basin, Shasta Co., July, 1932, *Peirson 10152* (Peirs); Lake Tahoe, Eldorado Co., June, 1932, *Maguire et al. 15046* (UAC); Cave Rock, Lake Tahoe region, 1909, *Eastwood 157* (Cl); 4 miles west of Sonora Pass, Alpine Co., Aug., 1938, *Constance 2405* (R); Glen Alpine Canyon, July, 1937, *Abrams 13412* (G, P); Tuolumne Meadows, Aug., 1916, *Smiley 758* (G); Mineral King, July, 1891, *Coville & Funston 1388* (G); Yosemite Valley, June, 1911, *Abrams 4452* (G); San Bernardino Mts., June, 1926, *Munz 10474* (P), July, 1924, *Munz & Johnston 8481* (P), July, 1902, *Abrams 2830* (G); Laguna Mts., San Diego Co., June, 1924, *Munz 8362* (P), May, 1925, *Peirson 5922* (Peirs). OREGON: Hoover Creek, Lillian Co., June, 1894, *Leiberg 132* (G); Ashland-Klamath Falls, July, 1920, *Peck 9232* (G). WASHINGTON: base of Mt. Adams, June, 1883, *Suksdorf 97* and *1915* (G); North Yakima, May, 1892, *Henderson 2393* (G); upper Yakima (River), Wash. Terr., 1860, *Lyll* (G); Swauk River, Kittitas Co., May-Sept., 1913, *Sharples 83* (G).

Critical students have often toiled with the numerous and seemingly unpredictable variations of *Arabis Holboellii* which occur in various parts of its natural geographical range. Some, including two recent authors,¹ have taken the stand that two or several species are represented by the plants which are here included under the single species with its varieties. However, there is no clear hiatus between the varieties as they are presented above, nor are there significant morphological differences between them. Hopkins l. c. who treated most of the "*Holboellii* complex", did not detect var. *typica* from western Washington or British Columbia. By thus limiting the distribution of typical *A. Holboellii* to Greenland and a few isolated stations in eastern America, it is admittedly easier to argue that "*A. retrofracta*" and "*A. pendulocarpa*", which are found chiefly in the Cordillera of western North America, are distinct species.

¹ Jepson, *Flora Calif.* 2: 66-68 (1936) and Hopkins in *RHODORA* 39: 170-186 (1937).

The facts are, as I see them, that the gradation of characters throughout the varietal series is too complete to allow the admission of even the leading varieties to specific rank. The varieties here recognized, as shown by the key, are based on trivial characters of pubescence and habit. They may not be entirely natural in every case, but the arrangement is orderly and the recognizable entities are easily determined as part of the species as a whole.

Such criteria as petal-size and the coarseness or fineness of stem-pubescence must be used with extreme care in the delimitation of *Arabis*-species. In measuring petal-width in the entity treated as *A. pendulocarpa* by Hopkins, for example, the measurement was found to vary from less than 1 mm. to more than 3 mm. Petal-length is equally variable, depending both on the stage of development and to a small extent on the position of the flower in the inflorescence. The last flowers to develop near the apex of the raceme often fail to attain the size of the lower ones which mature much earlier.

As regards pubescence in this immediate group, one must be equally wary. The young leaves in *A. Holboellii*, var. *typica* tend to be pannose, but as the leaf fully expands, the density of the pubescence decreases and one observes a spaced relationship between the dendritic trichomes. Var. *pendulocarpa*, var. *Collinsii* and var. *pinetorum* possess a coarse, spreading, almost hirsutulous type of pubescence on the lower stem and in general this character serves well to distinguish them from var. *retrofracta* and var. *typica*, but here again one finds a perplexing gradation from a coarse to a fine type of indument. The stem-pubescence of typical *A. Holboellii* is, in fact, about half-way between that of var. *retrofracta* and var. *pendulocarpa*. It is also significant that many of these gradations occur in specimens gathered at a single station; for example, the four sheets of the type-collection of var. *pendulocarpa* are quite variable with respect to the coarseness of stem-pubescence and two plants mounted on the same sheet at the Gray Herbarium, representing C. L. Hitchcock's no. 1569 from Ravalli County, Montana, have the extremes in coarseness and fineness of stem-pubescence, but are otherwise nearly identical. The proximity or remoteness of cauline leaves in this species is correlated with the stage of

development of the plant. Young plants nearly always have the cauline leaves closely imbricated, but as the stem lengthens these leaves may become separated by a centimeter or more.

A photograph of the type of *Streptanthus virgatus* Nuttall shows clearly that the specimen is an *Arabis*, but the accurate determination of the species cannot be made from the photograph alone. The single plant which constitutes the type is in flower only and resembles closely flowering specimens of *A. Holboellii*, var. *retrofracta*. However, a direct examination of the plant may show that it is really the same as the species which bears the name *A. lignifera* in the present work.

The complex nature of *A. Holboellii* is, in part at least, to be associated with the existence of polyploidy in the species. The common, wide-spread var. *retrofracta* is usually diploid, as shown by the cytological examination of six collections from California, Wyoming and Colorado, but a single collection from Utah was found to be tetraploid. Two collections of var. *pinetorum* from Colorado have proved to be polyploids, one tetraploid, the other hexaploid. Böcher¹ has reported the chromosome number of var. *typica* as $n = 22$. This count is not compatible with those I have made from other varieties of the species nor with other counts in the genus. The significance of such a number in this group is not at present understood. The effect of polyploidy in widening the range of variation within a given species seems to be borne out by such data as are available on *A. Holboellii*, but considerably more work on the cytology, genetics and geographical distribution of this species will be necessary before the complete story will be known.

38. *A. PUBERULA* Nuttall. Biennial or perennial; stems often stout, single or few from a simple caudex, simple or branched above, hoary throughout with a dense, dendritic pubescence, rarely becoming glabrous above, 1.5–5 dm. high; basal leaves dimorphic, oblanceolate to linear-oblanceolate, entire or few-toothed, acute, hoary with a minute dendritic pubescence, petiolate, 1–2 (–3) cm. long, 3–6 mm. wide; cauline leaves numerous, crowded, lanceolate to oblong, acute, entire or the lower irregularly toothed, sessile, densely pubescent, 1–3 cm. long, auricles small or absent; sepals oblong, densely pubescent, 4–6 mm. long, about 1.5 mm. wide, non-saccate; petals rose to

¹ Reprint from Meddelelser om Grønland 106: 100 (1938).

purple, rarely white, spatulate to narrower, 7–11 mm. long, 1.5–2.5 mm. wide; glandular tissue rather poorly developed, continuous beneath all stamens; fruiting pedicels curved downward, often strictly reflexed, densely pubescent, 4–8 mm. long; siliques numerous, pendulous to rather strictly reflexed, straight, usually blunt at apex, one-nerved below the middle, densely pubescent or less so in age, 3–6 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, plump, narrowly winged, slightly less than 2 mm. broad, uniseriate.—In T. & G., Fl. N. Am. **1**: 82 (1838); Piper in Contrib. U. S. Nat. Herb. **11**: 294 (1906) in part. *A. canescens* sensu Watson in Gray, Syn. Fl. N. Am. **1**: 165 (1895) in part; Rydb., Fl. Rky. Mts. 363 (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25**: 245 (1925) in part; Jepson, Fl. Calif. **2**: 67 (1936) in part. *A. Beckwithii* Watson in Proc. Am. Acad. **22**: 467 (1887) in part, and in Gray, Syn. Fl. N. Am. **1**: 165 (1895) in part; Tidestrom l. c. in part. *Erysimum puberulum* (Nutt.) O. Ktze., Rev. Gen. Pl. pt. **2**: 933 (1891). *A. subpinnatifida*, var. *Beckwithii* (Wats.) Jepson, Man. Fl. Pl. Calif. 431 (1925). *A. arida* Greene, Pittonia **4**: 190 (1900). *A. lignipes*, var. *impar* A. Nelson in Bot. Gaz. **54**: 139 (1912). *A. subpinnatifida*, var. *impar* (A. Nels.) Rollins in Res. Stud. State Coll. Wash. **4**: 32, fig. 8 (1936). *A. sabulosa* Jones, Contrib. West. Bot. **14**: 40 (1912). *A. sabulosa*, var. *frigida* Jones, ibid. p. 41. *A. sabulosa*, var. *colorata* Jones, ibid.—Idaho to Nevada, California and Washington. MAP 18. WITHOUT DEFINITE LOCALITY: Blue Mts., Columbia (probably Washington or Oregon), Nuttall s.n. (Ph, isotype; photo of TYPE in Gray). IDAHO: 2 miles from Salmon, Lemhi Co., May, 1924, Romano 8 (FS); Middle Valley (Midvale), Washington Co., April, 1900, Jones 6167 (UC, US); Squaw Creek (Sweet), May, 1911, Macbride 828 (RM, TYPE; C, UC, US, isotypes of *A. lignipes*, var. *impar*); Rattlesnake Creek near Dixie, Elmore Co., June, 1916, Macbride & Payson 2855 (G, NY, RM, US); Picabo, Blaine Co., July, 1916, Macbride & Payson 2996 (G, NY, RM, UC, US); Kingport Peak, near Pocatello, Bannock Co., May, 1925, Soth 539 (NY). NEVADA: near Owyhee, June, 1937, Murphy 210 (R); Wendover, Elko Co., June, 1934, Maguire et al. 5806 (UAC); Moor's Station, Elko Co., May, 1896, E. L. Greene s.n. (ND, TYPE of *A. arida*; photo in Gray); Palisade, Eureka Co., June, 1882, Jones 3761 (P, TYPE; Cl, NY, UAC, UC, US, isotypes of *A. sabulosa*); 15 miles west of Round Mountain, Toiyabe Mts., Nye Co., July, 1938, Rollins & Chambers 2509 (G, R); Paradise Valley, Humboldt Co., April, 1905, Kennedy 1065 (RM); Swan Lake, northern Washoe Co., June, 1939, Train 3008 (G, NA, R); (West) Humboldt Mts., Pershing Co., June, 1868, Watson 76 (G); July, 1894, Greene s.n. (ND); Lower Rochester, Pershing

Co., June, 1937, *Train 38* (R); Carson City, Ormsby Co., April, 1868, *Watson 76* (G); Kings Canyon, Ormsby Co., June, 1902, *Baker 985* (G, ND, NY); Nevada?, Quartz Mts.?, west of Great Salt Lake! *Lieut. Beckwith* (G, TYPE of *A. Beckwithii*). CALIFORNIA: Mt. Eddy, Siskiyou Co., July, 1920, *Heller 13434* (DS, P, US); Fort Bidwell, Modoc Co., July, 1903, *Manning 100b* (UC); Goose Lake Valley, May, 1894, *Austin 30* (ND, UC); above Parker Creek, Modoc Co., June, 1919, *Ferris & Duthie 65* (DS); Bieber Range, Lassen Co., June, 1920, *Smith 1200* (FS); Dixey Mts., Lassen Co., July, 1894, *Baker & Nutting s.n.* (UC); Diamond Mt., near Susanville, June 28, 1897, *M. E. Jones s.n.* (P, TYPE of *A. sabulosa*, var. *frigida*); vicinity of Doyles Station, Lassen Co., May, 1911, *Eggleston 6702* (US); Summit, Sierra Co., 1873, *Bolander 338* (M); Summit, Owens Valley, May 19 & 20, 1897, *M. E. Jones s.n.* (P, TYPE? of *A. sabulosa*, var. *colorata*). OREGON: Juniper Springs, Malheur Co., June, 1896, *Leiberg 2261* (G, NY, UC, US); Harper Ranch, Malheur Co., May, 1896, *Leiberg 2092* (G, O, UC, US); Camp Harney, Harney Co., May, 1885, *T. Howell s.n.* (G, O, US); near Prairie City, Grant Co., June, 1925, *Henderson 5289* (O); Forked Horn Butte, near Laidlaw, Crook Co., June, 1919, *Whited 99* (G, US, WSC); Deschutes Co., Aug., 1920, *Peck 9762* (W); Hart Mt., Lake Co., July, 1933, *L. Constance* (Henderson no. 15758) (O); Ingram Butte, Lake Co., July, 1929, *Ingram 3070* (FS); Pelican City, Klamath Co., May, 1923, *Applegate 3510* in part (DS, O); Brookside Ranch, Swan Lake Valley, Klamath Co., June, 1923, *Applegate 3586* (DS). WASHINGTON: Ellensburg, Kittitas Co., May, 1897, *Piper 2707* (WSC); Tampico, Yakima Co., May, 1899, *Flett 1125* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2389* (G, UW); near Bickleton, Klickitat Co., April, 1934, *Pickett et al. 1463* (WSC).

Arabis puberula is related to *A. subpinnatifida* and to *A. Holboellii*, var. *retrofracta*. As pointed out elsewhere, more abundant and accurate information on the life-histories of these plants may show that *A. subpinnatifida* should be given only subordinate rank under *A. puberula*. In habit and disposition of siliques, *A. puberula* resembles *A. Holboellii*, var. *retrofracta*, but ordinarily it can be distinguished by the fact that the siliques are densely pubescent, instead of being glabrous or only sparsely pubescent. The basal leaves of *A. puberula* tend to be dimorphic as in *A. subpinnatifida*. The leaves of the sterile shoots and first-year rosettes are much longer, narrower and more acuminate than the basal leaves of the fruiting stems.

The pubescence of *A. puberula* is hoary, being extremely dense on the stems, leaves and usually on the siliques. The seeds and siliques are broader and the flowers somewhat larger than any found in *A. Holboellii*, var. *retrofracta*.

In a former paper¹ *A. puberula* was treated and illustrated as *A. subpinnatifida*, var. *impar*. At that time the application of *A. puberula* was not properly known to me. Observing that plate 359 in Hooker's *Icones Plantarum*,² labeled *Arabis puberula*, was "taken from a specimen obligingly sent to us—by Mr. Nuttall", I had supposed the illustration to have been taken from an isotype or at least authentic material. Now that photographs of Nuttall's types of *A. canescens* and *A. puberula* in the British Museum have been obtained and isotype material of both has been examined at the Academy of Natural Sciences of Philadelphia, it is clear that Hooker illustrated Nuttall's *A. canescens*, but gave the description and locality of *A. puberula*. This mix-up has been the source of a seemingly perpetual misinterpretation of both *A. puberula* and *A. canescens*. Hooker's illustration is actually *A. cobrensis* Jones under which *A. canescens* Nuttall, being a later homonym, must now be placed.

The synonyms of *A. puberula* listed above are clear, except perhaps *A. Beckwithii*. When Watson described the latter species he cited four collections, without designating a type, as follows: "Nevada (Quartz Mountains, *Beckwith*; near Carson City, *Watson*; Candelaria, *Shockley*); San Bernardino Mountains, California (*Parish Brothers*, 1302)". The Beckwith and Watson specimens, though only in flower, appear to be merely *A. puberula*. The other two obviously belong to a different species and have been named *A. Shockleyi* by Munz. If, as seems reasonable, we are to associate the name *A. Beckwithii* with the Beckwith specimen as type, then the name must fall into the discard as a synonym of the older *A. puberula*.

39. *A. SUBPINNATIFIDA* Watson. Perennial; stems one to few from a simple or branched caudex, simple or branched above, densely pubescent with fine dendritic trichomes throughout or glabrous above, 1.5–4 dm. high; basal leaves dimorphic, leaves at base of flowering stems linear to linear-oblongate, acute, petiolate, dentate to somewhat incised, rarely entire, hoary with

¹ Res. Stud. State Coll. Wash. 4: 32 (1936).

² *Icones Plant.* 4: tab. 359 (1841).

a fine, dense, dendritic pubescence, 1–3 cm. long, 2–4 mm. wide, leaves of the sterile shoots narrowly linear-oblancoelate, acuminate, usually entire, 2–5 cm. long, densely pubescent; cauline leaves lanceolate to linear-lanceolate, acute, revolute, sessile or the lower having the suggestion of a petiole, subpinnatifid to irregularly dentate, rarely almost entire, hoary, 1–3 cm. long, 2–6 mm. wide, auricles small or absent; sepals oblong, scarious-margined, densely pubescent, often purplish, 5–7 mm. long; petals spatulate to lingulate, purple to lavender, 10–14 mm. long, 2–3 mm. wide; glandular tissue weakly developed, continuous under all stamens; flowering pedicels erect to divaricate; fruiting pedicels arched downward, pubescent, rather stout, 6–12 mm. long; siliques pendent, straight to slightly curved inward, glabrous to sparsely pubescent, 5–7 cm. long, 2–3.5 mm. wide, apex acuminate; style about 1 mm. long; seeds orbicular to slightly oblong, winged on the sides or sometimes all around, 1.5–2.5 mm. broad including wings, uniseriate.—Proc. Am. Acad. **20**: 353 (1885) and in Gray, Syn. Fl. N. Am. **1**: 165 (1895) in part; Howell, Fl. Northw. Am. **1**: 46 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2**: 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4**: 30, fig. 7 (1936).—OREGON and CALIFORNIA; Siskiyou Co.: Callahan, *Eastwood & Howell 5024* (R); east of Etna, April, 1938, *Horn 28* (G); Scott Valley, April and June, 1876, *Greene 711* (G, ND); Yreka, April, 1914, *L. E. Smith 636* (G). Trinity Co.: Mary Blaine Mt., Aug., 1935, *Tracy 14442* (UC); Trinity River Canyon, *Eastwood & Howell 4975* (R). Humboldt Co.: Grouse Mt., July, 1933, *Tracy 12878* (UC). OREGON: Jackson Co.: above Inns, July, 1930, *Henderson 12863* (O); Anderson's Camp east of Abbott Butte, July, 1899, *Leiberg 4279* (O, US); Abbott Butte, July, 1936, *Thompson 13057* (R, T). Josephine Co.: Waldo, June, 1884, *T. Howell s.n.* (G, TYPE; NY, T, US, isotypes); Kerby, April, 1926, *Henderson 5918* (M, O, RM); Rogue River near Galice, April, 1926, *Henderson 5917* (M, O, RM); Sexton Mt., April, 1934, *Thompson 10248* (T, US, W); near Merlin, March, 1927, *Peck 14775* (NY, W); Takilma, June, 1918, *Peck 8422* (G, W).

There is some question as to whether *A. subpinnatifida* should be kept up as a species now that the identity of Nuttall's *A. puberula* is clear. The plants formerly treated¹ as *A. subpinnatifida*, var. *impar* undoubtedly should be referred to *A. puberula*. In order to place these two entities in the same relationship nomenclaturally, it would be necessary to place *A. sub-*

¹ Res. Stud. State Coll. Wash. **4**: 32 (1936).

pinnatifida in varietal rank under *A. puberula*. This I should hesitate to do unless further investigation should indicate a closer affinity between the two than is now apparent. Ordinarily the two species will not be confused except, perhaps, in an area where they come together in western Nevada and northeastern California. *A. subpinnatifida* differs from *A. puberula* in having larger flowers and broader siliques. The siliques are acuminate at the apex, the style is about 1 mm. long and the cauline leaves are usually subpinnatifid in the former species. In *A. puberula* the cauline leaves are usually entire and the smaller, blunt siliques lack a definite style, the stigma being quite sessile.

Of the three specimens cited in the original publication of *A. subpinnatifida*, the specimen from the "West Humboldt Mts., Nev.", is *A. puberula*. The other two represent the species as here interpreted.

40. *A. COBRENSIS* M. E. Jones. Perennial; stems slender, several to many from a branched caudex, simple or usually branched above, softly pubescent with minute dendritic trichomes below, glabrate above, 2–5 dm. high; basal leaves numerous, entire, linear, acute, densely and finely pubescent with minute dendritic trichomes, hoary, 2–5 cm. long, 1–3 mm. wide; cauline leaves few, narrowly linear, entire, sessile, inconspicuously auriculate, often subtending a flower or branch, densely pubescent, 1–3.5 cm. long, 1–3 mm. wide; flowers small; sepals oblong, obtuse, non-saccate, sparsely pubescent, scarious-margined, 2–3 mm. long; petals white, narrowly clawed, about 4 mm. long, 1 mm. wide; glandular tissue continuous beneath all stamens; stamens nearly equal; fruiting raceme open; siliques straight or nearly so, pendulous or widely descending, sparsely pubescent pedicels, one-nerved below the middle, glabrous, obtuse, 3–5 cm. long, about 2 mm. wide; style very short or absent; seeds slightly oblong to nearly orbicular, about 2 mm. long, uniseriate, rather widely winged, wing about 0.5 mm. wide.—Contrib. West. Bot. **12**: 1 (1908). *A. canescens* Nuttall ex T. & G., Fl. N. Am. **1**: 83 (1838); Watson in Gray, Syn. Fl. N. Am. **1**: 165 (1895) in part; Coulter & Nelson, New Man. Bot. Rky. Mts. **228** (1909) in part; Rydberg, Fl. Rky. Mts. **363** (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25**: 245 (1925) in part, not *A. canescens* Brocchi in Bibleot. Ital. **29**: 90 (1823). *A. puberula* sensu Hooker, Icon. Pl. **4**: t. 359 (1841); Rollins in Res. Stud. State Coll. Wash. **4**: 34 (1936). *A. crypta* A. Nelson in Bot. Gaz. **56**: 473 (1913); Tidestrom, op. cit. p. 244.—Wyoming to Nevada and Oregon. MAP 17. LOCALITY UNCER-

TAIN: R.(ocky) Mts., *Nuttall s.n.* (G, Ph, isotypes of *A. canescens* Nutt.; photo of TYPE from Herb. Brit. Mus. in Gray Herb.). WYOMING: Orenda Butte, Red Desert, Sweetwater Co., June, 1900, *Nelson 7131* (RM); Point of Rocks, Sweetwater Co., June, 1897, *Nelson 3077* (G, M, RM, US); between Eden and Big Piney, Sublette Co., July, 1922, *E. B. & L. B. Payson 2569* (G, M, RM, UC, US); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1656* (G, R), June, 1938, *Rollins 2287* (G, R); Granger, Uinta Co., June, 1898, *Nelson 4700* (RM). IDAHO: desert near Big Butte, Butte Co., *R. J. Davis 167* (UIP). NEVADA: Cobre, Elko Co., June 16, 1906, *M. E. Jones s.n.* (P, TYPE; M, UC, US, isotypes); Jarbidge, Elko Co., July 4, 1912, *Nelson & Macbride s.n.* (RM, TYPE of *A. crypta*); Paradise Valley, Humboldt Co., April, 1905, *Kennedy 1055* (RM); Winemucca, May, 1917, *Wooton s.n.* (US); 5 miles north of Poehville, Washoe Co., June, 1938, *Tollotson 101* (R, VTM); Empire City, June, 1882, *Jones 3762* (Cl, M, US). OREGON: near Gateway, Jefferson Co., June, 1925, *Peck 13808* (W); between Prineville and Button Springs, Crook Co., June, 1894, *Leiberg 342* (US); camp at Dry Creek, Crook Co., July, 1894, *Leiberg 342* (G, O, UC); Fort Rock, Lake Co., June, 1911, *Eggleston 6835* (NY, US); base of Steens Mts., Harney Co., June, 1901, *Cusick 2567* (G, M, O, RM, UC, US, WSC).

This species was treated as *A. puberula* in a former paper.¹ The misapplication of the name was made as a result of my having followed the plate in Hooker's *Icones Plantarum*.² In the latter work, Nuttall's *A. canescens* is figured, but the plate is given as *A. puberula* Nutt., which is actually an entirely different species. An explanation of this error is given more fully under *A. puberula*.

A. cobrensis is found in the semi-arid to arid desert regions of the Great Basin area of western America. The stems are weak and often depend upon sagebrush or similar shrubby plants for support and protection. Its nearest relative is *A. puberula*, from which it differs in having remote instead of imbricated cauline leaves, glabrous instead of pubescent siliques and long linear basal leaves in place of short narrowly oblanceolate ones. *A. crypta* is based on an aberrant specimen of *A. cobrensis*. The type of *A. crypta* has abnormally short siliques caused by a high percentage of aborted ovules.

¹ Res. Stud. State Coll. Wash. 4: 34 (1936).

² Hook. Icon. Pl. 4: t. 359 (1841).

Otherwise the distinctive characters of *A. cobrensis* are unmistakably present. *A. cobrensis* is relatively homogeneous compared to many species of *Arabis*.

41. *A. SHOCKLEYI* Munz. Perennial, hoary with a fine dendritic pubescence; caudex simple, invested by old leaves and leaf-bases; stems one to few, simple to branched above, stout, densely pubescent throughout with minute dendritic trichomes, 1.5–3 dm. high; basal leaves crowded, spatulate, entire, short-petioled, hoary, 1–2 cm. long, 4–6 mm. broad; cauline leaves broadly lanceolate, acute, auricled but not clasping the stem, approximate, 1–1.5 cm. long, 3–6 mm. wide; sepals linear-oblong, pubescent, non-saccate, 5–7 mm. long, 1–1.5 mm. wide; petals linear-lanceolate, obtuse, pink, 8–11 mm. long, gradually tapering from blade to claw; glandular tissue continuous beneath all stamens, not highly developed; pedicels ascending, densely pubescent, 8–12 mm. long; siliques divaricate, crowded at apex of stem, straight to slightly curved, sparsely pubescent or glabrous, nerved at base only, often purplish, 5–8 cm. long, about 2 mm. wide; stigma sessile or nearly so; seeds oblong, plump, essentially wingless, 1 mm. broad, biseriate.—Bull. So. Calif. Acad. Sci. **31**: 62 (1932) and Man. So. Calif. Bot. 203 (1935).—Utah, Nevada and California. UTAH: Dutch Mountain, Tooele Co., June, 1900, *Jones 6169* (P). NEVADA: Millin Mt., Esmeralda Co., May, 1884, *W. H. Shockley 366* (G, TYPE; ND, US, isotypes). CALIFORNIA: dry canyon, north slope of the San Bernardino Mts., May, 1882, *S. B. & W. E. Parish 1302* (G, DS).

The type of *A. Shockleyi* was cited by Watson¹ under *A. Beckwithii* when that species was originally published. However, he had included two distinct species in *A. Beckwithii* and it remained for Munz to separate them correctly and give one a new name. The three cited collections of *A. Shockleyi* come from widely separated points in the Great Basin and Mohave Desert region. In spite of this, the plants are remarkably uniform and undoubtedly belong to the same species. The paucity of material of *A. Shockleyi* emphasizes the fact that many of the desert mountain-ranges where it presumably occurs have not been adequately explored. In many cases they have not even been visited by a botanist.

42. *A. inyoensis*, sp. nov. Herba perennis; caulibus paucis erectis robustis rigidis inferne pubescentibus superne glabris 2–5 dm. altis; foliis radicalibus numerosis lineari-oblongeolatis

¹ Proc. Am. Acad. **22**: 467 (1887).

vel spathulatis integris canescentibus 2–3 cm. longis, 2–5 mm. latis; foliis caulinis sessilibus oblongis auriculatis pubescentibus 1–2.5 cm. longis, 1.5–3 mm. latis; sepalis lineari-oblongis non saccatis pubescentibus 3.5–4.5 mm. longis; petalis roseis vel purpureis lingulatis vel spathulatis 7–9 mm. longis, ca. 2 mm. latis; pedicellis fructiferis divaricatis sparse pubescentibus vel glabris 6–12 mm. longis; siliquis glabris divaricatis 4–6 cm. longis, ca. 2 mm. latis; seminibus orbicularibus alatis ca. 1.5 mm. latis uniseriatis; cotyledonibus accumbentibus.

Deep-rooted perennial; stems several from an enlarged branching caudex, erect, rigid, densely pubescent below, glabrate above, 2–5 dm. high; basal leaves numerous, linear-oblong to spatulate, acute, entire, densely pubescent with dendritic trichomes, gray, 2–3 cm. long, 2–5 mm. wide, petiolate; cauline leaves sessile, oblong, auriculate, densely pubescent, gray, only slightly overlapping, 1–2.5 cm. long, 1.5–3 mm. wide; flowering pedicels ascending, sparsely pubescent; sepals linear-oblong, non-saccate, pubescent, 3.5–4.5 mm. long; petals pink to purplish, lingulate to spatulate, 7–9 mm. long, about 2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels spreading at right angles to rachis, glabrous to sparsely pubescent, 6–12 mm. long; siliques glabrous, spreading at right angles to rachis or slightly descending, nerved at base or up to the middle, straight or nearly so, 4–6 cm. long, about 2 mm. broad; seeds orbicular, winged, about 1.5 mm. broad, uniseriate, wing about 0.3 mm. wide; cotyledons accumbent.—CALIFORNIA: hills west of Big Pine, Inyo Co., May 15, 1906, *Heller 8259* (G, TYPE; M, NY, UC, US, isotypes); Darwin, April 28, 1897, *M. E. Jones s.n.* (P); Ralston, Sierra Nevada, July 22, 1920, *H. M. Evans s.n.* in part (P); mountain slope west of Heart Lake, Rock Creek Lake Basin, Inyo Co., Aug., 1940, *Peirson 12975* (G, R); Shepherd Canyon, April 30, 1897, *M. E. Jones s.n.* (P); Hanaupah Canyon, Panamint Mts., Inyo Co., May, 1932, *Munz 12559* (P); Keeler, Inyo Co., April 14—, *T. S. Brandegees s.n.* (G).

Arabis inyoensis is somewhat related to *A. lignifera*, but differs, among other ways, in having broader, straight instead of curved siliques, more rigid stems and more widely winged seeds. Our species also bears some relation to *A. pulchra* with which it agrees in type of pubescence. *A. inyoensis* may be distinguished from the latter species by its auriculate cauline leaves, uniseriate seeds and widely spreading, glabrous siliques. In habit, *A. inyoensis* somewhat resembles *A. dispar*, but the seeds, siliques and type of pubescence are wholly different in

the two. *A. inyoensis* borders the Mohave Desert in east-central California.

43. *A. PULCHRA* M. E. Jones ex Watson. Perennial with a sub-shrubby base; caudex simple or branching, usually elevated above ground; stems one to several, simple or branched, densely pubescent with minute appressed dendritic trichomes throughout to glabrous above, 2–6 dm. high; basal leaves linear, entire or rarely slightly dentate, obtuse, densely pubescent with minute dendritic trichomes, petiolate, 4–8 cm. long, 3–6 mm. broad; cauline leaves linear, sessile, densely pubescent, non-auriculate, 2–6 cm. long, 3–4 mm. broad; pedicels erect or divergent at anthesis, sharply recurved to pendulous in fruit, densely pubescent (glabrous or nearly so in var. *gracilis*), 8–20 mm. long; sepals oblong, densely pubescent, often purplish, 5–8 mm. long, 1.5–2.5 mm. wide, outer pair very slightly saccate; petals purple to reddish or white, broadly spatulate, 8–20 mm. long, 3–5 mm. wide; glands well developed, continuous beneath all stamens; siliques strictly reflexed to pendulous, straight, densely pubescent (glabrous or nearly so in var. *gracilis*), hoary when young, 4–7 cm. long, 2.5–3.5 mm. wide; valves thick, nerved to the middle or above; stigma sessile or the style very short; seeds nearly orbicular, rather prominently winged, 1.5–2 mm. broad, biseriate.

KEY TO THE VARIETIES OF *A. PULCHRA*

- a. Mature siliques strictly appressed on geniculately reflexed pedicels, densely pubescent; petals purple.....43a. var. *typica*.
- a. Mature siliques pendulous on arched pedicels, densely pubescent to glabrous; petals purple to white.....b.
- b. Siliques and upper stems glabrous or nearly so; pedicels glabrous to very sparsely pubescent, slender, 1–2 cm. long.....43d. var. *gracilis*.
- b. Siliques and upper stems densely pubescent; pedicels densely pubescent, stouter, 5–15 mm. long.....c.
- c. Petals purple, less than 1 cm. long. Western Utah, Nevada and California.....43b. var. *munciensis*.
- c. Petals white or rarely purple, 12–20 cm. long. Colorado and eastern Utah, southward.....43c. var. *pallens*.

43a. Var. *typica*. *A. pulchra* M. E. Jones ex Watson in Proc. Am. Acad. **22**: 468 (1887); Coville in Contrib. U. S. Nat. Herb. **4**: 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1**: 167 (1895); M. E. Jones, Contrib. West. Bot. **14**: 41 (1912); Rydberg, Fl. Rky. Mts. 360 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25**: 244 (1925); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2**: 69 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 79, fig. 167 (1940).—Nevada and California to Baja California, Mexico. MAP 23. NEVADA: Empire City, Ormsby Co., June 19, 1882, *M. E. Jones 3765* (G,

TYPE; Cl, NY, P, US, isotypes); Carson City, Ormsby Co., June, 1897, *M. E. Jones s.n.* (P); Reno, Washoe Co., June 12, 1894, *Hillman s.n.* (P); 1 mile east of Virginia City, May, 1937, *Moore & Franklin 26* (R); pass west of Lida, Esmeralda Co., June, 1919, *Tidestrom 9846* (US). CALIFORNIA: above Lake Sabrina at head of Bishop Creek, Inyo Co., Aug., 1938, *Constance 2465* (R); Lone Pine, Inyo Co., May, 1897 & May, 1927, *M. E. Jones s.n.* (P); 18 miles south of Ryan, Inyo Co., April, 1928, *Peirson 7807* in part (Peirs); Willow Springs, Kern Co., April, 1926, *Munz 10033* (P); Frazier Borax Mine, Ventura Co., June, 1908, *Abrams & McGregor 202* (G, NY, US); 4 miles southwest of Fairmont, Los Angeles Co., April, 1932, *Wheeler 569* (G); near Palmdale, Los Angeles Co., April, 1937, *Eastwood & Howell 3968* (G); Whitewater, Riverside Co., April, 1880, *Parish Bros. 97* (G); Hesperia, San Bernardino Co., April, 1917, *Spencer 391* (G, P, US); near Jacumba, San Diego Co., May, 1903, *Abrams 3643* (G, NY, P). MEXICO: 50 miles southeast of Tecate, Baja California, May, 1925, *Munz 9560* (P).

43b. Var. *MUNCIENSIS* M. E. Jones. Pedicels gently spreading downward, never geniculately reflexed; siliques pendulous.—Contrib. West. Bot. **14**: 42 (1912).—Western Utah to eastern California. MAP 23. UTAH: between St. George and Beaver Dam Mts., May, 1919, *Tidestrom 9319* (US); Milford, May, 1903, *S. G. Stokes s.n.* (US). NEVADA: Muncy, White Pine Co., May 19, 1906, *M. E. Jones s.n.* (P, TYPE), June 25, 1906, *M. E. Jones s.n.* (P); Ferguson Spring, White Pine Co., June, 1900, *M. E. Jones s.n.* (P); Tonopah, April, 1907, *M. E. Jones s.n.* (P); Candelaria, Mineral Co., May—, *Shockley 218* (G); first canyon north of Pioche, Ely Range, Lincoln Co., April, 1939, *Train 2653* (G, NA, R). CALIFORNIA: Darwin, April, 1897, *M. E. Jones s.n.* (P).

43c. Var. *PALLENS* M. E. Jones. Petals white or rarely purple, 1.2–2 cm. long, 4–5 mm. wide at apex; pedicels arching downward or rarely more strictly reflexed; siliques pendulous.—Contrib. West. Bot. **14**: 42 (1912). *A. formosa* Greene, Pitt. **4**: 198 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. **228** (1909); Wootton & Standley in Contrib. U. S. Nat. Herb. **19**: 280 (1915); Rydberg, Fl. Rky. Mts. **360** (1918).—Western Colorado, eastern Utah and adjacent Arizona and New Mexico. MAP 23. COLORADO: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2201* (G, R); 8 miles west of Grand Junction, May, 1938, *Rollins 2169* (G, R); Grand Junction, May, 1892, *Eastwood s.n.* (G, US); near Westwater, Utah, but in Mesa Co., Colo., May 6, 1891, *M. E. Jones s.n.* (P, TYPE; G, NY, US, isotypes); Naturita, April, 1914, *Payson 245* (G, Ph, RM); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2120*

(G, R). NEW MEXICO: Aztec, April, 1899, *C. F. Baker* 345 (US, TYPE; G, NY, RM, isotypes of *A. formosa*). UTAH: 8 miles south of Manila, Daggett Co., June, 1938, *Rollins* 2281 (G, R); 14 miles west of Vernal, Uintah Co., June, 1937, *Rollins* 1748 (G, R); San Rafael Swell, Emery Co., May, 1914, *M. E. Jones s.n.* (P); Lower Crossing (Woodside), Emery Co., July, 1898, *M. E. Jones s.n.* (P); La Sal Mts., June, 1913, *M. E. Jones s.n.* (P); Cisco, May, 1890, *M. E. Jones s.n.* (P, US); near Bluff, San Juan Co., April, 1936, *Maguire* 13518 (R). ARIZONA: vicinity of Kayenta, 1922, *Wetherill s.n.* (NY).

43d. Var. *GRACILIS* M. E. Jones. Pubescence coarser and less dense than in var. *typica*; stems glabrous above; pedicels arched downward, never geniculately reflexed, slender, 1–2 cm. long; siliques pendulous, glabrous or nearly so.—Contrib. West. Bot. **8**: 41 (1898); Munz, Man. So. Calif. Bot. 205 (1935). *A. trichopoda* Greene in Fedde, Rep. Nov. Sp. **5**: 242 (1908), not *A. trichopoda* Turcz. in Bull. Mose. **8**: 63 (1840). *A. pulchra* Jones, var. *glabrescens* Wiggins in Contrib. Dudl. Herb. **1**: 100 (1929). *A. pulchra* Jones, var. *viridis* Jepson, Fl. Calif. **2**: 70 (1936).—Nevada and California. MAP 19. NEVADA: Calientes, Lincoln Co., April, 1904, *M. E. Jones s.n.* (NY, P); Meadow Valley Wash, April, 1904, *M. E. Jones s.n.* (P); Goodsprings, Clark Co., May, 1905, *M. E. Jones s.n.* (P). CALIFORNIA: Silver Canyon, east of Laws, Inyo Co., May, 1906, *Heller* 8191 (G); Dantes Point, Inyo Co., April, 1928, *Munz & Hitchcock* 11014 (P); Shepherd Canyon, Argus Mts., May 1, 1897, *M. E. Jones s.n.* (P, TYPE; US, isotype; also type and isotype of *A. trichopoda*); Granite Well, above Cooper City, May, 1922, *Johnston* 6552 (P, RM); Providence Mts., May, 1920, *Munz et al.* 4263 (P); Cactus Flat, San Bernardino Mts., May, 1926, *M. E. Jones s.n.* (P); Cima Road, 10 miles south of Las Vegas Road, April, 1930, *Peirson* 8733 (Peirs); Jacumba-Mountain Springs, April, 1920, *Eastwood* 9541 (G); Jacumba, April, 1924, *Eggleston* 19773 (G, P); Julian-Banner, March, 1926, *Wiggins* 2015 (G, P, US, isotypes of *A. pulchra*, var. *glabrescens*).

That *A. pulchra* is made up of a series of several varieties was first recognized by Jones, l. c., who studied the species as he explored much of the arid area it occupies. His three varieties, which have a measure of geographical discreteness, are accepted as probably representing natural subdivisions of the species. The very densely pubescent siliques and biseriate seeds will easily identify all plants of *A. pulchra*, except var. *gracilis*, which has nearly glabrous siliques and pedicels. *A. pulchra* is a weak-stemmed plant with a sub-shrubby base. It is very

often found tangled among desert shrubs from which it derives support. The very large-flowered var. *pallens* usually has white flowers, but sometimes purple flowers are also found. The latter variety was named *A. formosa* by Greene, but the plants certainly do not represent a distinct species.

Jepson¹ states that Jones "first recognized and named this species and indicated (in herb.) as the type his specimens (Jones 3764) from Empire City, Ormsby Co., Nev. June 19, 1882". These data are correct except that the type is *Jones, no. 3765* in the Gray Herbarium, the specimen from which the original description was drafted by Watson. Two sheets of this number are in the Jones Herbarium at Pomona College. Fortunately, *Jones 3764* is not the type because three of the four sheets bearing that number which I have examined are *A. sparsiflora*, var. *typica*, the fourth is a mixture of the latter plant and *A. pulchra*.

44. *A. TRICORNUTA* Rollins. Perennial; stems single, branched above, pubescent below with simple or branched trichomes, glabrous above, 3–6 dm. high; basal leaves caducous, unknown; lower cauline leaves petiolate, oblanceolate, pubescent with harsh 2- or usually 3-pronged trichomes, 3–5 cm. long, about 1 cm. wide; upper cauline leaves linear to narrowly lanceolate, glabrous; inflorescence lax, slender, greatly elongated; sepals glabrous, nearly ovate to broadly oblong, 3–4 mm. long, 2–3 mm. wide, unequal, non-saccate, inner pair tapering at base; petals white, narrowly spatulate, thickened toward base with edges rolled outward, arose to entire along upper margin, not strongly differentiated into blade and claw, 4–5 mm. long, about 1.5 mm. wide; stamens slightly shorter than petals, filaments of single stamens curved, filaments of paired stamens straight; glandular tissue surrounding base of single stamens, continuous beneath paired stamens, well developed; pedicels slender, gently curved downward, glabrous, 1–1.5 cm. long; siliques glabrous, 1-nerved to middle or above, spreading at right angles to widely pendulous, often secund, 3–7 cm. long, about 2 mm. wide; style about 1 mm. long; stigma entire; seeds flat, orbicular, conspicuously winged all around, about 1.5 mm. broad, uniseriate; cotyledons obliquely accumbent.—In Kearney and Peebles in Journ. Wash. Acad. Sci. **29**: 478 (1939).—ARIZONA: Eastview, Rincon Mts., Oct. 13, 1909, *J. C. Blumer 3478* (G, TYPE); Rincon Mts., 1891, *Neally 120* in part (US); Santa Rita Mts., Aug. 23, 1936, *Darrow & Arnold s.n.* (G).

¹ Fl. Calif. **2**: 70 (1936).

Arabis tricornuta is particularly interesting because at anthesis it is very difficult to distinguish from *Thelypodium micranthum*. In habit, inflorescence, flower and type of pubescence they are almost identical. One minor feature of flower-similarity is particularly striking. In both species the short stamens arise at right angles to the ovary and then curve upward. This particular characteristic has not been observed in other species of *Arabis*, but it is not of major importance as a diagnostic character, since there is considerable variation in stamen-insertion throughout the genus. The definitely winged seeds, accumbent cotyledons and markedly flattened siliques of *A. tricornuta* leave little doubt about its being properly placed in *Arabis*, in spite of the striking similarity it shows to another species of a different genus. *A. tricornuta* is not closely related to any North American species of *Arabis*, but the flower, inflorescence, and upper parts of the plant are similar to *A. laevigata*. It is somewhat like *A. repanda*, particularly as regards the petiolate cauline leaves, but the similarity is only superficial. *A. tricornuta* is apparently restricted to the mountains of southern Arizona where it has been collected at elevations of between seven and nine thousand feet.

45. *A. REPANDA* Watson. Perennial; caudex simple or branched; pubescence of forked or dendritic trichomes; stems one to few, branched above, densely pubescent below, sparsely pubescent to glabrous above, green to purplish, (1-) 2-7 dm. high; basal leaves rosulate, petiolate, deeply toothed, repand or entire, densely pubescent, oblanceolate to broadly spatulate, obtuse, 3-7 cm. long, 1-3 cm. wide, petiole winged; cauline leaves petiolate or the upper sessile, broadly oblanceolate to nearly linear, densely pubescent, often subtending the somewhat flexuous branches, 1-6 cm. long, 0.5-2 cm. wide, entire to repand; inflorescences rather lax, terminating the stem-branches; pedicels stout, straight, divaricately ascending to erect, pubescent to rarely glabrous, 3-6 (-10) mm. long; sepals pubescent, linear-oblong, 4-5 (-6) mm. long, 1-2 mm. wide, non-saccate, outer pair slightly longer than the inner; petals white to pinkish, nearly linear, narrow at base, 4-6 mm. long, about 1 mm. wide; all stamens nearly equal in length; nectar-glands weakly developed, nearly surrounding all stamens; siliques divaricately ascending, straight or often falcate, pubescent to glabrous, linear, coriaceous, nerved to the middle or usually nerveless, 4-10 cm.

long, 2–4 mm. wide; style slender, 1 mm. or less long; seeds orbicular to slightly elliptical, widely winged, 2–4 mm. broad including wings; cotyledons accumbent.

45a. Var. **typica**. *A. repanda* Watson in Proc. Am. Acad. **11**: 122 (1875); Brewer & Watson, Bot. Calif. **1**: 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4**: 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1**: 161 (1895); Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2**: 63 (1936).—Nevada and California. MAP 10. NEVADA: 8 miles southwest of Reno, Sierra Nevada, Washoe Co., June, 1938, *Archer 6111* (G, NA, R), July, 1938, *Archer 6259* (NA, R); 10 miles southwest of Carson City, Douglas Co., June, 1938, *Archer 6032* (NA). CALIFORNIA: west of Alder Springs, Glenn Co., July, 1917, *Heller 12799* (Cl, G, M, NY, US); near Floriston, Nevada Co., June, 1934, *J. T. Howell 11836* (G); Stanislaus Forest, Alpine Co., July, 1913, *Eggleston 9573* (US); Bridgeport Quadrangle, Eagle Creek, Mono Co., July, 1937, *Hendrix 329* (VTM); Yosemite Valley, Mariposa Co., 1866, *H. N. Bolander 4881* (G, TYPE); above Whiskey Creek, 1 mile below Ellis Meadow, Madera Co., July, 1938, *Constance 2386* (R); Giant Forest, Tulare Co., July, 1905, *T. S. Brandegee s.n.* (NY); near Mineral King, Tulare Co., July, 1891, *Coville & Funston 1389* (G, US); Tehachapi, Kern Co., June, 1889, *E. L. Greene s.n.* (US); Frazier Mt., Ventura Co., July, 1905, *Hall 6614* (UC); North Baldy Mt., Los Angeles Co., July, 1908, *Abrams & McGregor 589* (G, US); Bear Valley, San Bernardino Mts., San Bernardino Co., June, 1895, *S. B. Parish 3752* (G, UC, US), Aug., 1902, *Abrams 2863* (G, NY, P, US); North Fork Tahquitz Creek, San Jacinto Mts., Riverside Co., Sept., 1922, *Munz 6386* (P).

45b. Var. **GREENEI** Jepson. Stems 1–3.5 dm. high; leaves entire to slightly dentate; pedicels sparsely pubescent, 5–10 mm. long; siliques glabrous, 2–2.5 mm. wide, nerved at least to the middle; style about 1 mm. long; seeds about 2 mm. broad including wings.—Fl. Calif. **2**: 63 (1936). *A. inamoena* Greene, Leaflets **2**: 158 (1911), not *A. inamoena* Greene in Fedde, Repert. Nov. Sp. **5**: 243 (1908).—MAP 10. CALIFORNIA: 19 miles south of Mono Lake, Mono Co., Aug., 1938, *Constance 2461* (R); South Lake, Inyo Co., July, 1913, *Davidson 2956* (G); Lake Sabrina, Bishop Creek, Inyo Co., July 11—, *Davidson 2729* (ND, TYPE); Rock Creek Lake Basin, west of Heart Lake, Inyo Co., Aug., 1933, *Peirson 10768* (P, Peirs).

Plants of *A. repanda* have been collected at various altitudes ranging from 5,000 to 11,500 ft., but they appear to be most abundant in the pine belt. A dwarfed variety of the species was named *A. inamoena* by Greene, l. c., the name being a

homonym of his own earlier *A. inamoena* which in turn is synonymous with *A. platysperma*. Jepson, l. c., renamed the later *A. inamoena* of Greene as *A. repanda*, var. *Greenei*, stating that it "is at most of varietal value". The variety *Greenei* is based on its small size, entire or nearly entire leaves and usually longer style than that found in var. *typica*. None of these features is completely consistent in the four collections examined. The siliques of var. *Greenei* are nerved below, glabrous, and the seeds are less widely winged than those of var. *typica*.

There is some variation in the amount of vestiture on different plants of var. *typica*. The type, together with a number of other collections, has pubescent siliques, but in the majority of specimens of *A. repanda* studied the siliques are glabrous. There is evidence that mature siliques are sometimes glabrous only because the indument has been shed. Other species of *Arabis*, such as *A. pulchra* and *A. puberula*, are known to shed the indument from their siliques and the phenomenon is in line with the general evidence regarding the unreliability of the presence or absence of vestiture as a criterion in the genus.

46. *A. GLAUCOVALVULA* M. E. Jones. Perennial; stems one or several from a ligneous, branching caudex, fairly robust, simple or branching above, hoary throughout, 1.5–4 dm. high; basal leaves linear to slightly broader, entire, obtuse, densely pubescent with dendritic trichomes, hoary, 2–5 cm. long, 2–5 mm. wide; cauline leaves lanceolate to linear-lanceolate, sessile, non-auriculate, densely pubescent throughout, 1–4 cm. long, 2–5 mm. broad; sepals oblong, reddish, non-saccate, pubescent, 4–5 mm. long, 2 mm. broad; petals with an oblong blade which is narrowed to a slender claw, pink to whitish, 6–8 mm. long, about 2 mm. wide; nectar-glands developed under single stamens, nearly obsolete under the paired stamens; pedicels stout, strongly recurved, densely pubescent; siliques reflexed, oblong, obtuse at both ends, glabrous and glaucous, one-nerved to the middle or often the entire length, 2–4.5 cm. long, 5–8 mm. wide; style evident, less than 1 mm. long; seeds orbicular, very widely winged, 5–6 mm. broad including the wings, biseriate.—Contrib. West. Bot. **8**: 40 (1898); Jepson, Man. Fl. Pl. Calif. 432, fig. 419 (1925) and Fl. Calif. **2**: 71 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 82, fig. 170 (1940).—California and Nevada. MAP 18. CALIFORNIA: Keane Spring, Inyo Co., May, 1932, *Munz 12577* (P); Darwin Mesa, Argus Mts., May 8, 1897, *M. E. Jones s.n.* (P, TYPE; M, NY, Ph, RM,

UAC, UC, US, isotypes); 2 miles west of Darwin, May, 1932, *Munz 12489* (M, P, UC); Black Mts., Death Valley, May 2, 1927, *E. C. Jaeger s.n.* (P); Bishop Creek, Inyo Co., May, 1906, *Hall & Chandler 7246* (M, UC); 10 miles southeast of Windmill Tank, April, 1932, *C. L. Hitchcock 12241* (P); 3 miles east of Warren's Well, San Bernardino Co., May, 1922, *Munz & Johnston 5179* (Cl, G, NY, RM); Lanfair Valley, eastern San Bernardino Co., May, 1935, *Munz 13704* (P); Cottonwood Springs, Riverside Co., May, 1905, *Hall 6019* (UC), April, 1932, *C. L. Hitchcock 12241* (P); White Tanks, eastern Riverside Co., April, 1932, *Munz & Hitchcock 12231* (M, P); Keyes Ranch, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5251* (Cl, UC, US).

Arabis glaucovalvula is one of the most distinctive species in the genus and has a very restricted range, bordering the Mohave Desert in California and Nevada. I have not seen specimens from Nevada, but a single collection is reported from that state by Jepson, l. c. The linear basal leaves, moderately fine dendritic pubescence, non-auriculate cauline leaves and biseriate seeds seem to relate this species to *A. pulchra*, while the broad siliques and large and widely winged seeds indicate something of an affinity with *A. platysperma* and *A. suffrutescens*. Actually, *A. glaucovalvula* is not closely allied to any other known species.

47. *A. DISPAR* M. E. Jones. Perennial; stems several from a branching, lignescent caudex, simple or branched above the base, densely pubescent below, less so above, 1–2.5 dm. high; basal leaves numerous, entire, erect, spatulate to linear-oblancoate, slender-petioled, hoary with a dense, fine, dendritic pubescence, 1.5–2.5 cm. long, 2–4 mm. broad; cauline leaves sessile, broadly linear, reduced upwards, hoary, 1–2 cm. long, 1.5–2 mm. broad; sepals oblong, pubescent, purplish with scarious margins, about 4 mm. long, 1.5 mm. wide; petals obovate, purplish, not differentiated into blade and claw, 5–6 mm. long, about 2 mm. wide at apex; pedicels nearly erect to divaricate, pubescent, 1–2 cm. long; siliques divaricate to more ascending, glabrous, acute, 5–7 cm. long, 2.5–3.5 mm. wide, mid-nerve prominent below, absent above the middle; stigma sessile to subsessile; seeds nearly orbicular, widely winged, about 2 mm. broad, imperfectly uniseriate.—Contrib. West. Bot. **8**: 41 (1898); Munz, Man. So. Calif. Bot. **203** (1935); Jepson, Fl. Calif. **2**: 71 (1936). *A. nardina* Greene, Leaflets **2**: 70 (1910); Jepson, l. c. *A. salubris* Jones, Contrib. West. Bot. **14**: 37 (1912). *A. juniperina* Jones,

Contrib. West. Bot. **15**: 68 (1929).—MAP 17. CALIFORNIA: Pleasant Canyon, Panamint Mts., Inyo Co., May 6, 1897, *M. E. Jones s.n.* (P, TYPE; M, UAC, US, isotypes); north fork of Hanaupah Canyon, Panamint Mts., May, 1932, *Munz 12569* (P); Mill Canyon, Panamint Mts., May, 1891, *Coville & Funston 776* (US, TYPE; G, isotype of *A. nardina*); near Bishop, Inyo Co., May 13, 1927, *M. E. Jones s.n.* (P); Cactus Flat in Cushenbury Canyon, May 13, 1927, *M. E. Jones s.n.* (P, TYPE of *A. juniperina*); north slope of the San Bernardino Mts., San Bernardino Co., May, 1892, *S. B. & W. F. Parish 1300* (G); Quail Springs, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5214* (Cl, G, P, RM).

The types of *A. dispar* and *A. nardina* are almost identical in every way except for the slightly narrower siliques on that of *A. nardina*. This difference is certainly not of sufficient definitive importance to warrant the maintenance of two names for an otherwise homogeneous entity. The type of *A. juniperina* is a slightly larger plant than the average and the siliques are a trifle more ascending than is usually found in *A. dispar*, but these are only minor variations to be expected as a response to local environmental conditions. *A. dispar* is most closely related to *A. Johnstonii*, but is separated from it on a number of fundamental points stressed in a discussion under that species.

I was not able to find a type for *A. salubris* at the Pomona College Herbarium. Jones's citation of the type-specimen is nearly identical with that for the type of *A. dispar*. From the descriptions it seems almost certain that he described the same collection under two different names, *A. dispar* in 1898 and *A. salubris* in 1912.

48. *A. JOHNSTONII* Munz. Perennial, densely pubescent with fine dendritic trichomes; stems several from a ligneous, branching caudex, erect or ascending, simple to branched, pubescent throughout, 1–2 dm. high; basal leaves entire, linear-oblong to narrowly spatulate, petioled, 1–2 cm. long, 1.5–3.5 mm. wide, hoary with a fine dense dendritic pubescence; cauline leaves entire, sessile, not auriculate, lanceolate to linear-oblong, hoary, 1–1.5 cm. long, 2–5 mm. wide; sepals purplish, oblong, pubescent, 4.5–6 mm. long, about 1.5 mm. wide, outer pair slightly saccate at base; petals purple, spatulate, 8–10 mm. long, 2–3 mm. wide; ovary glabrous; pedicels ascending, pubescent, 6–10 mm. long; siliques very shortly stipitate, erect, glabrous, one-nerved to the middle or above, 3–5 cm. long, 2–3 mm. wide,

apex acuminate; style slender, persistent, 1–2 mm. long; seeds nearly orbicular, widely winged, about 1.5 mm. broad, uniseriate.—In Bull. So. Calif. Acad. Sci. **31**: 63 (1932) and Man. So. Calif. Bot. **204** (1935).—Southern CALIFORNIA: Riverside Co.: Kenworthy, San Jacinto Mts., May 19, 1922, *Munz & Johnston 5485* (P, type; G, isotype), May, 1937, *Munz 15123* (G, P); near Toro Mt., San Jacinto Reserve, March, 1898, *Leiberg 3173* (US); Hemet Valley, San Jacinto Mts., *Peirson 3030* (Peirs).

A. Johnstonii is related to *A. dispar*, but is readily distinguished by its more ascending, shorter siliques, short gynophore, slender persistent style, larger purple petals and slightly saccate outer sepals. In general appearance, specimens of *A. Johnstonii* look like “grown-up” plants of *A. Parishii*. These species are related, but are easily separated on a number of characters. The flower is smaller and the style much shorter, yet the siliques are much larger in *A. Johnstonii* than in *A. Parishii*. The latter species has small, very narrowly winged seeds instead of the large, broad-winged seed which is characteristic of *A. Johnstonii*. At present the known range of *A. Johnstonii* is limited to a single mountain-system, the San Jacinto Mts. of southern California.

49. *A. PARISHII* Watson. Perennial; stems several to numerous and tufted from a subterranean branching caudex, slender, simple, densely pubescent with dendritic trichomes below, less so upward, 3–14 cm. high; basal leaves numerous, entire, narrowly linear-oblongate, tapering to a short petiole, acute, hoary with a fine dendritic pubescence, 5–15 mm. long, 1–2 mm. wide; cauline leaves few, sessile, entire, not petioled nor auricled, hoary, linear, 5–10 mm. long, 1–2 mm. wide; sepals oblong, green or purplish, pubescent, 3–4 mm. long; petals purple, bluish or rarely almost white, spatulate, tapering to a very narrow claw, 8–13 mm. long; pedicels erect to slightly spreading, rather stout, pubescent, 3–7 mm. long; siliques ascending, glabrous, nerved to the middle or above, 1–2 cm. long, 2–3 mm. wide, acuminate; style filiform, 4–8 mm. long; seeds elliptical to nearly orbicular, narrowly winged, 1–1.5 mm. broad, imperfectly uniseriate.—Proc. Am. Acad. **22**: 468 (1887) and in Gray, Syn. Fl. **1**: 167 (1895); Jepson, Man. Fl. Pl. Calif. **433** (1925) and Fl. Calif. **2**: 72 (1936); Munz, Man. So. Calif. Bot. **203**, fig. 101 (1935).—San Bernardino County, CALIFORNIA: Bear Valley, San Bernardino Mts., June, 1886, *Parish 1793* (G, TYPE; UC, isotype), June, 1895, *Parish 3751* (G, UC, US), June, 1922, *Munz 5751* (G); near Baldwin Lake, San Bernardino Mts., June,

1924, *Munz 8179* (G, NY); Sugarloaf Mt., San Bernardino Mts., July, 1906, *Hall 7537* (M, RM, UC); June, 1922, *Peirson 3101* (G, Peirs, RM).

Arabis Parishii is distinctive in habit, character of the style and localization of range. The specific circumscription is clear, yet its relationship to *A. Johnstonii* and *A. dispar* is unmistakable. It is found, chiefly in exposed places, from the upper canyon-slopes to the higher peaks and ridges of the San Bernardino Mountains in southern California. The species could be usefully introduced into cultivation as a rock-garden plant of exquisite beauty.

50. *A. SUFFRUTESCENS* Watson. Suffruticose perennial; stems several to many from a widely branching caudex, simple or rarely branched above, glabrous (pubescent below in var. *horizontalis*), (1-) 2-5 dm. high; basal leaves linear to oblanceolate or sometimes nearly spatulate, acute to obtuse, glabrous or rarely sparsely pubescent (densely pubescent in var. *horizontalis*), 1-4 cm. long, 2-6 mm. wide; cauline leaves few, sessile, auriculate (non-auriculate in var. *perstylosa*), lanceolate to narrowly obovate, acute or the lower obtuse, glabrous or rarely with a few marginal trichomes, 1-3 cm. long, 2-6 mm. wide; flowers few; sepals oblong to slightly broader, glabrous, 3.5-4.5 mm. long; petals spatulate, rose to purplish, 6-8 mm. long, 2.5-3 mm. wide; pedicels slender, glabrous, horizontal to strictly reflexed, 4-10 mm. long; siliques pendulous to strictly reflexed (horizontal in var. *horizontalis*), glabrous, one-nerved from base to above middle or often to the tip, acuminate, 4-7 cm. long, 3-6 mm. wide, venation evident; style less than 1 mm. long or absent (2-3.5 mm. long in var. *perstylosa*); seeds orbicular, widely winged, 2-3.5 mm. wide including wings, imperfectly uniseriate, papery wings about 1 mm. wide; cotyledons accumbent.

KEY TO THE VARIETIES OF *A. SUFFRUTESCENS*

- Styles less than 1 mm. long or absent; cauline leaves auriculate;
 siliques horizontal to strictly reflexed.
 Siliques pendulous to strictly reflexed; plants 2-5 dm. high;
 basal leaves and lower stems glabrous or nearly so...50a. var. *typica*.
 Siliques horizontally spreading; plants 1-2 dm. high; basal
 leaves and lower stems densely pubescent.....50b. var. *horizontalis*.
 Styles 2-3.5 mm. long; cauline leaves non-auriculate; si-
 liques strictly reflexed.....50c. var. *perstylosa*.

50a. Var. **typica**. *A. suffrutescens* Watson in Proc. Am. Acad. 17: 362 (1882) and in Gray, Syn. Fl. N. Am. 1: 166 (1895); Howell, Fl. Northw. Am. 1: 45 (1897); Piper in Contrib. U. S.

Nat. Herb. **11**: 295 (1906); Rydberg, Fl. Rky. Mts. 360 (1918); Jepson, Man. Fl. Pl. Calif. 432 (1925) and Fl. Calif. **2**: 70 (1936); Rollins in Res. Stud. State Coll. Wash. **4**: 48, fig. 15 (1936). *A. duriuscula* Greene, Pitt. **4**: 191 (1900). *A. dianthifolia* Greene, Leaflets **2**: 76 (1910).—Idaho to California and Washington. MAP 19. IDAHO: ridge west of Cascade, Valley Co., July, 1937, *Thompson 13852* (G, R); Payette National Forest, Aug., 1912, *Martineau & Sparhawk 59* (FS); Rush Creek, Washington Co., July, 1899, *Jones 6164* (NY, RM, UC, US); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3481* (G, NY, RM); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3070* (G, NY, RM, US), June, 1938, *C. L. Hitchcock 3826* (R); above Galena, Blaine Co., July, 1895, *Henderson 3537* (US). CALIFORNIA: Medicine Lake, Siskiyou Co., July, 1921, *Eastwood 10885* (G, US); Shackleford Creek, Siskiyou Co., July, 1910, *Butler 1705* (RM, UC, US); Salmon-Trinity Alps, Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13379* (G, R); Lassen Forest, Lassen Co., July, 1933, *Fischer & Johnson F273* (UC); 1000 Lake Basin, Shasta Co., July, 1932, *Peirson 10151* (Peirs, UC); Donner Lake, Nevada Co., July, 1893, *Michener s.n.* (ND, TYPE of *A. duriuscula*; photo in Gray Herb.); Truckee, Nevada Co., June, 1892, *Sonne 9* (NY, UC); Mt. Lola, Nevada Co., July, 1903, *Hall & Babcock 4539* (UC); Kaiser Crest, Fresno Co., July, 1914, *Smiley 621* (G). OREGON: mouth of Battle Cr., Wallowa Co., July, 1933, *Peck 17616* (NY, W); bluffs of Snake River and vicinity, Baker Co., 1881, *W. C. Cusick 919* (G, TYPE); stony hills near Snake River, Baker Co., May, 1898, *Cusick 1898* (G, UC, US, WSC); Steens Mts., Harney Co., July, 1896, *Leiberg 2514* (G, NY, O, US); Santiam Nat. Forest, Linn Co., 1920, *Ingram 1360* (OS); near Paulina Lake, Deschutes Co., June, 1931, *J. T. Howell 7097* (G), July, 1920, *Peck 9685* (G, NY, T, W); Crater Lake, Klamath Co., Sept. 14, 1902, *Coville 1511* (US, TYPE of *A. dianthifolia*), July, 1928, *Wynd 2250* (O); near Buck Lake, Jackson Co., July, 1936, *Thompson 13121* (T). WASHINGTON: Wenaha River Trail, Columbia Co., July, 1913, *Darlington s.n.* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2398* (UW); Mt. Adams, probably Yakima Co., Aug., 1885, *Suksdorf 511* (G), May, 1884, *Suksdorf 633* (UC, US, WSC), Aug. 15, 1882, *T. Howell s.n.* (O, T, US).

50b. Var. *HORIZONTALIS* (Greene) Rollins. Stems numerous, slender, 1–2 dm. high, pubescent below; basal leaves pubescent with dendritic trichomes; cauline leaves nearly ovate to oblong, pubescent or the upper glabrous; pedicels 4–8 mm. long, glabrous, horizontally spreading; siliques horizontal, 2–4 cm. long, 2.5–4 mm. wide.—Res. Stud. State Coll. Wash. **4**: 50 (1936);

Applegate in Am. Midl. Natur. **22**: 269 (1939). *A. horizontalis* Greene, Leaflets **2**: 74 (1910).—Southern OREGON: Crater Lake, Klamath Co., Aug. 1, 1897, *Coville & Applegate 334* (US, TYPE; RM, isotype), July, 1929, *Wynd 1545 & 1547* (O); Llaio Rock, Crater Lake, July, 1924, *Hall 11972* (DS); Mt. Garfield, July, 1918, *Heller 13040* (G, NY, US).

50c. Var. **perstylosa**, var. nov. Herba glabra; foliis caulinis sessilibus, non auriculatis; stylis filiformibus 2–3.5 mm. longis. Plants glabrous or very rarely with a few trichomes along the margins of the basal leaves; stems one to several or many; cauline leaves remote, sessile, non-auriculate; siliques strongly nerved; style persistent, slender, 2–3.5 mm. long.—MAP 19. CALIFORNIA: open bare serpentine slope, above Middle Fork of the Feather River, 7.3 miles southeast of Quincy, Plumas County, June 9, 1938, *Lincoln Constance 2309* (G, TYPE; R, isotype).

There is considerable variation in the width of the siliques in *A. suffrutescens*. On the average, plants from Washington, eastern Oregon and Idaho seem to have slightly broader siliques than those from southern Oregon and California, but this is only a tendency and the species could not be divided, using silique-width as a basis. Var. *typica* is usually glabrous throughout, but specimens with branched trichomes along the basal leaf-margins or even on the blade-surfaces are occasionally found. The leaves are ordinarily fairly narrow and acute, although plants in which the lower cauline and basal leaves are broad and obtuse are sometimes collected. Neither *A. dianthifolia* Greene nor *A. duriuscula* Greene have characteristics which serve to separate them from *A. suffrutescens*. They do not even represent end points of normal trends in specific variation.

Variety *horizontalis* is distinguished from var. *typica* by its lower stature, more numerous, slender stems, shorter pedicels, horizontally spreading, smaller siliques and rather densely pubescent basal leaves. The plants are quite distinctive in appearance. However, they possess the basic characteristics of *A. suffrutescens* and must be included in the species as a whole. The variety is known from several stations, all within Crater Lake National Park.

Known only from the single collection cited, var. *perstylosa* is distinguished from var. *typica* by its long style and non-auriculate cauline leaves. Var. *typica* often has a sessile stigma or the style may reach a millimeter in length, but in var.

perstylosa, the style is never less than 2 mm. long and is usually about 3 mm. in length. Ordinarily, species of *Arabis* vary in the length of the style, and, were it not for the fact that this character is associated with the lack of auricles on the cauline leaves, one might suggest that var. *perstylosa* is only a marked variant of var. *typica*. These rather marked characteristics associated together are sufficient, it seems to me, to warrant making the separation.

51. A. **PLATYSPERMA** Gray. Perennial, pubescence dendritic; stems several to numerous from a simple or branching caudex, erect to somewhat decumbent, simple or often branched above, pubescent to glabrous, (0.5-) 1-4 dm. high; basal leaves numerous, oblanceolate or narrower, acute to obtuse, rather densely pubescent to glabrous, entire, 2-5 cm. long, 3-8 mm. wide; cauline leaves few, remote, oblong to linear-lanceolate, sessile, not auriculate (except occasionally in var. *Howellii*), pubescent or glabrous, 1-1.5 cm. long, 2-5 mm. wide; sepals oblong, non-saccate, pubescent or glabrous, 3-4 (-5) mm. long; petals pink to white, spatulate, 4-6 (-7) mm. long, 2-3 mm. wide; glandular tissue continuous beneath all stamens, often surrounding single stamens; pedicels divaricately ascending, straight, pubescent or glabrous, 5-15 mm. long; siliques erect to divaricately ascending, straight, broad, flat, acuminate, 3-7 cm. long, 3-5 mm. wide; valves distinctly veined, nerved toward the base; style less than 1 mm. long or absent; seeds orbicular, widely winged, 3-4 mm. broad including the wings, uniseriate; cotyledons accumbent.

51a. Var. **typica**. Basal leaves, lower stems and sepals pubescent; stems 1-4 dm. high; cauline leaves never auriculate; sepals 3-4 mm. long; petals 4-6 mm. long; stems very often branching above.—*A. platysperma* Gray in Proc. Am. Acad. **6**: 519 (1865); Watson in King, Geol. Expl. Fortieth Parallel **5**: 16 (1871); Brewer & Watson, Bot. Calif. **1**: 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4**: 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1**: 163 (1895); Howell, Fl. Northw. Am. **1**: 45 (1897) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25**: 243 (1925); Jepson, Man. Fl. Pl. Calif. 432, fig. 420 (1925) and Fl. Calif. **2**: 71, fig. 138 (1936) in part; Munz, Man. So. Calif. Bot. 204 (1935); Rollins in Res. Stud. State Coll. Wash. **4**: 47, fig. 14 (1936) in part. *Erysimum platyspermum* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. inamoena* Greene in Fedde, Rep. Nov. Sp. **5**: 243 (1908), not *A. inamoena* Greene, Leaflets **2**: 158 (1911). *A. oligantha* Greene in Fedde, Rep. Nov. Sp. **5**: 243 (1908).—Nevada, California and Oregon.—MAP 25. NEVADA: Sierra Nevada above Virginia City, Ormsby Co.,

July, 1939, *Train 3251* (NA, R); near Mt. Rose, Aug., 1938, *J. T. Howell 14060* (G); 20 miles southwest of Reno, June, 1937, *Henrichs s.n.* (G); along Galena Creek, 7 miles west of Reno Hot Springs, Washoe Co., July, 1937, *Archer 5667* (R); divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932a* (G, NY, UC, US); East Humboldt Mts., Sept., 1868, *Watson 69* (G, NY, US). CALIFORNIA: Half Moon Meadow, Marble Mt. Primitive Area, Siskiyou Co., Aug., 1939, *S. K. & C. C. Harris 6039* (G, R); Mt. Shasta, Siskiyou Co., Sept., 1897, *Canby 16* (G), 1860–62, *Brewer 1393* (G, US); headwaters of Hat Creek, Shasta Co., July–Aug., 1911, *Eggleston 7433* (G, NY, US); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* (NY, UC); near Jonesville, Butte Co., July, 1917, *Heller 12859* (G, US), June, 1931, *Copeland 643* (NY, RM, UC); Soda Springs, Nevada Co., July, 1881, *M. E. Jones 2512* (NY, UAC, UC, US); Donner Pass, Placer Co., July, 1903, *Heller 6975* (G, NY, RM, UC, US); Echo Camp, Eldorado Co., Aug., 1915, *Heller 12176* (G, NY); Ebbetts Pass, Alpine Co., 1863, *Brewer 1989* (G, TYPE; UC, US, isotypes); Cloud's Rest-Moraine Dome, Yosemite National Park, July, 1936, *Helen Sharsmith 3809* (G, R); Belle Meadow, Tuolumne Co., July, 1934, *Wiggins 6898* (G); near Devil's Postpile, Madera Co., Aug., 1938, *J. T. Howell 14469* (G, R); Long Meadow, Tulare Co., June 7–12, 1888, *E. Palmer 192* (US, TYPE; NY, isotype of *A. inamoena*); 0.2 mile east of Sonora Pass, Mono Co., Aug., 1938, *Constance 2449* (R); region of Dinkey Creek, Fresno Co., June–July, 1900, *Hall & Chandler 354* (US, TYPE; NY, UC, isotypes of *A. oligantha*); Baldy Mt. (Mt. San Antonio), San Bernardino Co., Aug., 1880, *Parish Bros. 498* (G); Dollar Lake, San Bernardino Mts., Aug., 1922, *Munz 6241* (G, RM); San Jacinto Mts., San Bernardino Co., June, 1921, *Jaeger 577* (US); Tahquitz Ridge, San Jacinto Mts., July, 1908, *Reed 2527* (UC). OREGON: Mt. Scott, Klamath Co., *Thompson 12290* (G, NY).

51b. Var. *HOWELLII* (Watson) Jepson. Entire plant glabrous or rarely with a few trichomes along the petiole of the basal leaves, often dwarfed at high altitudes; stems 0.5–3 dm. high; sepals glabrous, 3–5 mm. long; petals obtuse, 5–7 mm. long; cauline leaves sometimes auriculate.—*Man. Fl. Pl. Calif.* 432 (1925). *A. Howellii* Watson in *Proc. Am. Acad.* **25**: 124 (1889) and in Gray, *Syn. Fl. N. Am.* **1**: 167 (1895); Howell, *Fl. Northw. Am.* **1**: 45 (1897). *A. platyloba* Greene in *Pitt.* **4**: 198 (1900); Tidestrom in *Contrib. U. S. Nat. Herb.* **25**: 243 (1925). *A. platysperma* sensu Howell, *Fl. Northw. Am.* **1**: 45 (1897) in part; Rollins in *Res. Stud. State Coll. Wash.* **4**: 46 (1936) in part. *A. chionophila* Greene ex C. F. Baker, *West Am. Pl.* [1] 16 (1902). *A. conferta* Greene in *Fedde, Rep. Nov. Sp.* **5**: 243

(1908). *A. Covillei* Greene, *ibid.* *A. Leibergii* Greene, *ibid.* *A. platysperma* Gray, var. *imparata* Jepson, Fl. Calif. **2**: 72 (1936). *A. inamoena* Greene, var. *acutata* Jepson, *ibid.*—Nevada, California and Oregon. MAP 24. NEVADA: divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932* (G, NY, UC, US); Marlette Lake, Washoe Co., July, 1902, *Baker 1389* (G, UC, US); Mt. Rose, Washoe Co., July, 1937, *Breene 523* (NA, R); Snow Valley, Ormsby Co., June, 1912, *Baker 1157* (ND; photo in Gray Herb. This specimen was labeled *A. chionophila* by Greene and is the basis for *A. chionophila* Greene ex Baker, West. Am. Pl. [1] 16 (1902), *nomen nudum*). CALIFORNIA: Caribou Basin, Salmon-Trinity Alps, Siskiyou Co., July, 1937, *J. T. Howell 13444* (G, R); Devil's Canyon Mts., Trinity Co., *Tracy 14712* (R, UC); Mt. Shasta, Aug., 1882, *Pringle 18* (G); Lake Solfatara, Lassens Peak, Shasta Co., 1896, *Mrs. R. M. Austin s.n.* (ND, TYPE; US, isotype of *A. platyloba*; photo of type in Gray Herb. This collection is also the basis for *A. platysperma* Gray, var. *imparata* Jepson); Benson Pass, northern part of Yosemite Nat. Park, Aug., 1936, *Helen Sharsmith 3810* (G, R); Conness Trail, near Young's Lake, Tuolumne Co., July, 1937, *Peirson 7610* (Peirs, TYPE of *A. inamoena*, var. *acutata*); Ragged Peak, Tuolumne Co., July, 1936, *Mason 11264* (G); terminal moraine of Conness Glacier, Mono Co., July, 1936, *Mason 11425* (G); Taboose Pass, Inyo Co., *Peirson 2535* (Peirs); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1492* (US, TYPE; G, NY, isotypes of *A. Covillei*); mountain near Little Kern River, April–Sept., 1897, *Purpus 5231* (US, TYPE; G, UC, isotypes of *A. conferta*). OREGON: Mt. Hood, Hood River Co., Sept., 1880, *J. & T. J. Howell 309* (G, US); Mt. Jefferson, Jefferson Co., Aug., 1919, *J. C. Nelson 2881* (G); west slope of Middle Sister, Lane Co., July, 1914, *Peck 2720* (G); Paulina Peak, Deschutes Co., June, 1931, *J. T. Howell 7053* (G); north of Mt. Bachelor, Deschutes Co., July, 1931, *J. T. Howell 7129* (G); Crater Lake, Klamath Co., Aug., 1916, *Heller 12633* (G, NY, OS, US); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 436* (US); Gayhart Buttes (Gearhart Mt.) Aug., 1896, *Coville & Leiberg 262* (US, TYPE of *A. Leibergii*); Ashland Butte, Jackson Co., July 19, 1887, *T. Howell 664* (G, TYPE; OS, Ph, T, US, isotypes), July, 1935, *Thompson 12333* (G); near Oregon Caves, Josephine Co., July, 1918, *Peck 8330* (G, W).

Arabis platysperma varies rather widely in height and in the size and shape of its foliar organs. At high altitudes the plants are apt to be considerably dwarfed, with numerous stems less than 1 dm. high. Conversely, at lower altitudes, particu-

larly in favorable sites, the stems may reach 4 dm. in height. These variations apparently accompany differing conditions of habitat and are only rarely correlated with slight dimensional differences observable in such conservative organs as the flower. In spite of the variation in habit, the flowers and fruits remain fairly constant throughout.

The two points noted by Greene as justifying the segregation of *A. inamoena*, "pubescent sepals and very short colorless petals", are both perfectly characteristic of typical *A. platysperma*. The very short colorless petals are found when the flower first opens, later the petals elongate and often become pink- or purplish-tipped. I cannot see anything in the type-specimen of *A. oligantha* which differs particularly from the type of *A. platysperma*.

It has been with some hesitation that the pubescent and glabrous phases of *A. platysperma* have been separated. I do not believe the two varieties are natural, even though var. *Howellii* does have a more northerly range and is usually found at higher altitudes than var. *typica*. So far as I have been able to determine, the glabrous condition is not correlated with any constant character such as width or shape of the siliques, as suggested by Jepson, l. c. At the very highest altitudes, var. *Howellii* becomes exceedingly dwarfed and in the northern part of its range the flowers tend to be slightly larger than in the southern. In general the same series of variations run through var. *Howellii* as are found in var. *typica*.

An interesting repetition occurred when Jepson, l. c., proposed var. *imparata* for the glabrous, broad-podded phase of *A. platysperma*. This variety was based on a collection by Mrs. R. M. Austin from Lake Solfatara, Lassens Peak, California, which Greene, l. c., earlier used as the basis for his *A. platyloba*. The plants of this collection are glabrous and the siliques are very wide, but there is nothing fundamentally distinctive about them. In the present treatment they are placed with the glabrous, usually more dwarfed var. *Howellii*. *A. inamoena*, var. *acutata* is an extremely dwarfed form of var. *Howellii* with rather narrow basal leaves. The siliques are markedly acute, due largely to their immaturity, but this is not a singular character in the species.

52. *A. pygmaea*, sp. nov. Herba perennis; caudicibus simplicibus vel ramosis foliis emortuis persistentibus tectis; caulibus tenuibus erectis simplicibus inferne pubescentibus superne glabratis vel pubescentibus 5–10 cm. altis; foliis radicalibus integris linearibus hispidulis 1–2 cm. longis, 1–2 mm. latis, pilis furcatis vel simplicibus; foliis caulinis paucis remotis linearibus sessilibus non auriculatis hispidulis 5–10 mm. longis, 1–2 mm. latis; sepalis pubescentibus ca. 2 mm. longis; petalis albis?; pedicellis adscendentibus sparse pubescentibus 5–8 mm. longis; siliquis erectis acuminatis glabris 2–4 cm. longis, 4–5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis 2.5–3.5 mm. latis; cotyledonibus accumbentibus.

Perennial, caudex simple or branched, usually covered with a series of hemispherical clusters of dead leaves; stems several, slender, erect to slightly decumbent, simple, rather densely pubescent below with forked trichomes, sparsely pubescent above or glabrate, 5–10 cm. high; basal leaves tufted, entire, narrowly linear, hispid with coarse forked trichomes, marginal trichomes often simple and larger than those on the blade surfaces, 1–2 cm. long, 1–2 mm. wide; cauline leaves few, remote, sessile, non-auriculate, linear, loosely hispid, 5–10 mm. long, 1–2 mm. wide; sepals pubescent, about 2 mm. long; petals white?; pedicels ascending, sparingly pubescent, 5–8 mm. long; siliques erect, straight, somewhat acuminate, mid-nerve rather obscure, netted venation evident, glabrous, 2–4 cm. long, 4–5 mm. wide; stigma sessile; seeds orbicular, broadly winged, 2.5–3.5 mm. broad including wings; funiculi free, slender, 2–3 mm. long; cotyledons accumbent.—CALIFORNIA: Basin of the Upper Kern River, Volcano Meadows (originally known as Whitney Meadows), Tulare Co., July 21, 1904, *H. M. Hall & H. D. Babcock 5465* (G, TYPE; M, NY, OS, US, isotypes); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5465* (RM; the collection bears the same number as the above, but it is marked with a different locality and date); Moraine Lake to Big Arroyo, headwaters of the Kern River, July, 1916, *M. L. Campbell s.n.* (Calif. Acad. Sci.).

This species is evidently the one described under *A. inamoena* Greene by Jepson,¹ though I have not seen any of the collections cited. *A. inamoena*, var. *acutata* of the same publication is *A. platysperma*, var. *Howellii*. As shown by the type-specimen, *A. inamoena* Greene (1908) is nothing more than typical *A. platysperma*. The statement in Greene's description, "caulibus tenuibus 1–1.5 cm. altis", has possibly been responsible for the misapplication of the name *A. inamoena* to the plants here

¹ Fl. Calif. 2: 72 (1936).



A. PYGMAEA drawn from *Hall & Chandler 5465*. About one and one-half times natural size.

named *A. pygmaea*. It is probable that "cm." in the above quotation is a misprint for "dm.", since both the type at the U. S. National Herbarium and an isotype at the New York Botanical Garden show the stems to be 1–2 dm. high. *A. pygmaea* is related to *A. platysperma*, the siliques and seeds of each being almost identical. The significant differences between the two are found in the foliage, pubescence and habit of growth. Definitive statements concerning these characters are given in the key.

53. *A. PETIOLARIS* Gray. Annual or biennial ?; single stem simple below, robust, usually branched above, pilose at base, becoming glabrous upward, 4–10 dm. high; basal leaves long-petioled, lyrate to pinnately lobed, pilose on both surfaces, 1–1.5 dm. long, 2–6 cm. wide; cauline leaves long-petioled, lower similar to the basal, pilose to glabrate; upper reduced, entire to rarely dissected, lanceolate, glabrous; sepals oblong, glabrous, 3–5 mm. long, 1–1.5 mm. wide; petals pink, spatulate, 6–8 mm. long, 1.5–2 mm. wide; filaments often attached to petals at base; glandular tissue weakly developed, continuous under all stamens; pedicels glabrous, divaricately ascending, straight, 8–12 mm. long; siliques flattened, broad, acuminate, straight, divaricately ascending, 4–8 cm. long, 3–4 mm. wide; style slender, 1–2 mm. long; seeds orbicular, widely winged all around, 3–4 mm. broad including the wings, uniseriate.—Proc. Am. Acad. **6**: 187 (1863); Coulter in Contrib. U. S. Nat. Herb. **2**: 19 (1891); Watson in Gray, Syn. Fl. N. Am. **1**: 161 (1895); Cory & Parks in Texas Agric. Exp. Sta. Bull. **550**: 48 (1938). *Streptanthus petiolaris* Gray in Mem. Am. Acad. **4**: 7 (1849). *S. brazoensis* Buckley in Proc. Acad. Sci. Phila. **448** (1861). *Erysimum petiolare* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891).—Central TEXAS: rocky hill, Austin, Travis Co., May, 1872, *E. Hall* 17 (G, NY, US); Barton Creek Valley, near Austin, April, 1918, *Young* 24 (G); San Marcos Spring, Hays Co.?, 1847, *C. Wright s.n.* (G, TYPE); San Marcos, Hays Co., April, 1917, *Palmer* 11562 (RM); Coleman County, April, 1882, *Reverchon* 4 (G); Makewater Creek, Coleman Co., April, 1882, *Reverchon* 1246 (US); Bear Mountain, Gillespie Co., May, 1935, *Cory* 12875 (G); San Saba, San Saba Co., May, 1917, *Palmer* 11797 (RM); New Braunfels, Comal Co., May, 1851, *Lindheimer* 517 & 674 (G), May, 1850, *Lindheimer* 675 (G, NY); western Texas to El Paso, May–October, 1849, *Wright* 5 (G); San Antonio, Bexar Co., *M. E. Jones* 798 (P); Bexar County, June, 1904, *Jermey s.n.* (NY).

Arabis petiolaris is different from all other American species of *Arabis* in having strongly petiolate, somewhat dissected cauline leaves. *A. tricornuta* and *A. repanda* have petiolate cauline leaves, but they are not dissected, nor is the petiole strongly developed. In some respects *A. petiolaris* resembles certain members of the genus *Sibara*, but in the aggregate its characters are those of an *Arabis*. O. E. Schulz¹ has placed this species in a separate section of *Arabis* § *Oxytria*. That *A. petiolaris* is a very distinctive species of *Arabis* is unquestioned, but I cannot agree with Schulz that it is the only *Arabis*-species which has apiculate anthers. A number of American species, including *A. crucisetosa*, *A. furcata*, *A. blepharophylla*, *A. aculeolata* and several others, have this character very plainly marked.

SPECIES EXCLUDED FROM *ARABIS* OR WITH NAMES OF
UNCERTAIN APPLICATION

1. *A. Bolanderi* Watson in Proc. Am. Acad. **22**: 467 (1887)² was based upon plants with sterile siliques.

2. *A. Brebneriana* A. Nelson in Bull. Torr. Bot. Club **25**: 373 (1898) = *Halimolobos virgatus* (Nuttall) O. E. Schulz in Engler, Pflanzenr. **4**: fam. 105, 290 (1924).

3. *A. Bourgovii* Rydberg in Mem. N. Y. Bot. Gard. **1**: 186 (1900), based on *Turritis patula* Graham. See footnote under *Arabis patula* (Graham) Torrey below.

4. *A. elata* Piper in Proc. Biol. Soc. Wash. **37**: 91-92 (1924). The type of this species in the U. S. National Herbarium has sterile siliques and is otherwise deformed. It is believed that normal plants would be referable to one of the varieties of *A. sparsiflora* Nuttall.

5. *A. Endlichii* O. E. Schulz in Notizbl. **11**: 390 (1932) = *Sibara Viereckii* (Schulz) Rollins, var. **Endlichii** (Schulz), comb. nov.

6. *A. filifolia* Greene in Bull. Calif. Acad. Sci. **2**: 390 (1887) = *Sibara filifolia* Greene in Pittonia **3**: 11 (1896).

¹ Engler's Bot. Jahrb. **66**: 94 (1933).

² When Watson described *A. Bolanderi*, he cited three specimens as follows, "Yosemite or Mono Pass (Bolander); mountains of Washington Territory (Brandegee); also collected by Dr. Torrey, a more glabrous form, probably in the mountains of California, but ticketed in his herbarium as from Colorado." These specimens have one thing in common. They all bear sterile siliques. Otherwise, they probably belong to three separate species, but the presence of nothing but aborted ovules, sterile siliques and the attendant effects of sterility on the plants, makes their identification difficult. I have not been able to place confidently Bolander's specimen, the type of *A. Bolanderi*, with any California species of *Arabis*, but it appears to belong with one of the varieties of *A. Holboellii*. The Brandegee specimen from Washington is almost certainly a variety of *A. sparsiflora* Nuttall, but the Torrey specimen is too fragmentary to be placed at all. I suggest the name *A. Bolanderi* be discarded on the grounds that it is of uncertain application to living plants; it was based on three discordant elements (the specimens probably belong to three separate species), and its type is a near-monstrosity.

7. *A. hastatula* Greene, Leaflets **2**: 79 (1910). The type in the U. S. National Herbarium is a flowering specimen not certainly determinable, but I believe it should be referred to *A. Holboellii*, var. *retrofracta* (Grah.) Rydb.

8. *A. Holboellii* Hornem., var. *patula* (Grah.) Watson in Gray, Syn. Fl. N. Am. **1**: 164 (1895), based on *Turritis patula* Graham. See footnote below under *Arabis patula* (Graham) Torrey.

9. *A. Hookeri* Lange, Consp. Fl. Groen. **3**: 50 (1880) = *Halimolobos mollis*¹ (Hooker) comb. nov., based on *Turritis mollis* Hooker, Fl. Bor.-Am. **1**: 40 (1829).

10. *A. longirostris* Watson in King, Geol. Expl. Fortieth Parallel **5**: 17, pl. 1 (1871) = *Streptanthella longirostris* (Watson) Rydberg, Fl. Rky. Mts. 364 (1918).

11. *A. Menziesii* (Hook.) A. Nelson in Proc. Biol. Soc. Wash. **18**: 187 (1905) = *Phoenicaulis cheiranthoides* Nuttall in T. & G. Fl. N. Am. **1**: 89 (1838).

12. *A. Menziesii lanuginosa* Nelson & Macbride in Bot. Gaz. **55**: 374 (1913) = *Phoenicaulis cheiranthoides*, var. *lanuginosa* (Watson), comb. nov., based on *Parrya Menziesii*, var. *lanuginosa* Wats. in Gray, Syn. Fl. N. Am. **1**: 152 (1895).

13. *A. Menziesii*, var. *lata* Nelson & Macbride, l. c. = *Phoenicaulis cheiranthoides* Nutt.

14. *A. mexicana* Watson in Proc. Am. Acad. **17**: 319 (1882) = *Sibara mexicana*, comb. nov.

15. *A. patula* (Graham) Torrey, Bot. U. S. & Mex. Bound. Surv. **1**: 32 (1859), based on *Turritis patula*² Graham in Edinb. New Phil. Journ. 350 (1829); not *Arabis patula* Host, Fl. Austr. 271 (1831).

16. *A. pectinata* Greene, Pittonia **1**: 287 (1889) = *Sibara pectinata* Greene, Pittonia **3**: 11 (1896).

¹ This species is very closely related to *Halimolobos virgatus* of the Rocky Mountain area. It is interesting to note that Hooker originally compared it to the Mexican and South American *Turritis hispidula* which is now also included in *Halimolobos*.

² *Turritis patula* has not been identified with any modern species of *Arabis*, although the description is full and it is certain that the plant described is an *Arabis*. Apparently no type was preserved at Edinburgh (see Hopkins in RHODORA **39**: 134) and it has been impossible to determine which of several Rocky Mountain species of *Arabis* should bear the name. I am inclined to think the name should be associated with one of the varieties of *A. sparsiflora*, but Hopkins, l. c., thought the description could be applied to plants of *A. divaricarpa*. My own notion on the matter is supported to some extent by a specimen of *A. sparsiflora*, var. ? in the Torrey Herbarium of the New York Botanical Garden marked "Franklin's Journey Dr. Hooker" with the fruiting portion marked "cultivated." Both annotations are presumably in the handwriting of Asa Gray. Does this specimen represent part of the garden material from which Graham drew his description of *Turritis patula*? In so far as the specific name *patula* is concerned, the identity of Graham's plant is not important because the same specific epithet was used in *Arabis* several times before Torrey made the transfer based on Graham's name. However, two species have been proposed using *Turritis patula* Graham as their basynym, and it is with them that we must deal. *Turritis Grahamii* Lehmann in Litt.-Bericht zur Linnaea für das Jahr 1831, p. 74, is the oldest substitute name I know about and it antedates the names in current use. Also *Arabis Bourgoyii* Rydberg in Mem. N. Y. Bot. Gard. **1**: 186 (1900) is a substitute name for *Turritis patula* Graham, therefore resting on the same type. At present it is impossible to assign the names based on Graham's description to any species of *Arabis*. If a type is discovered, then this will be possible.

17. *A. pedicellata* A. Nelson in Proc. Biol. Soc. Wash. **17**: 91 (1904) = *Phoenicaulis cheiranthoides*, var. *lanuginosa* (Watson) Rollins.
 18. *A. runcinata* Watson in Proc. Am. Acad. **17**: 319 (1882) = *Sibara runcinata*, comb. nov. (Not *A. runcinata* Lam., Encycl. **1**: 222 (1783).
 19. *A. Viereckii* O. E. Schulz in Notizbl. **11**: 389 (1932) = *Sibara Viereckii* (Schulz), comb. nov.
 20. *A. virginica* (L.) Poir. Encycl. Suppl. **1**: 413 (1810) = *Sibara virginica* (L.), comb. nov., based on *Cardamine virginica* L., Sp. Pl. **2**: 656 (1753).
 21. *A. Whitedii* Piper in Bull. Torr. Bot. Club **28**: 39 (1901) = *Hali-molobos Whitedii* (Piper), comb. nov.

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VIBURNUM EDULE AND ITS NOMENCLATURE

M. L. FERNALD

VIBURNUM EDULE (Michx.) Raf. in Med. Repos. hex. **2**, v. 354 (1808); Pursh, Fl. Am. Sept. i. 203 (1814), in part only. *V. Opulus*, γ. *edule* Michx. Fl. Bor.-Am. i. 180 (1803). *V. Opulus pauciflorum* Raf. Alsog. Am. **58** (1838). *V. pauciflorum* La Pylaie ex Torr. & Gray, Fl. N. Am. ii. 17 (1841). *V. Opulus*, var. *eradiatum* Oakes in Hovey's Mag. vii. 183 (1841). *V. eradiatum* (Oakes) House in Am. Midl. Nat. vii. 130 (1921).

In its nomenclatural misinterpretations *Viburnum edule* well illustrates the failures to go to original sources which lead to so many errors in the names of our American plants. In § *Opulus* we have three species, two endemic Americans and the introduced Eurasian *V. Opulus*. Briefly their diagnostic characters are as follows.

- Petioles exstipulate at base, glandless at summit or with small glands at base of leaf-tissue; blades shallowly lobed or unlobed; cymes 1.5–3.5 cm. broad, of uniform perfect flowers; stamens much shorter than corolla-lobes; straggling to erect shrub. *V. edule*.
 Petioles with slender basal stipules, usually with glands well below the leaf-tissue; blades deeply lobed; cymes 0.4–1.5 dm. broad, their marginal flowers neutral and with greatly enlarged flat corollas; stamens of perfect flowers longer than corolla-lobes; upright shrubs or small trees.
 Glands on petioles dome-shaped, columnar or clavate, with rounded summits; stipules filiform-clavate or with thickened tips. *V. trilobum*.
 Glands on petioles forming depressed concave-topped disks; stipules filiform-attenuate, with slender tips. *V. Opulus*.

Viburnum trilobum Marsh. is the American species which is often merged with the Eurasian *V. Opulus*. Michaux, Fl. Bor.-Am. i. 180 (1803) divided *V. Opulus* into three varieties:

Var. α . *europaeum*.

β . *Pimina*: foliis tricuspidatis; lobis sursum angustatis promissae acuminatis.

γ . *edule*: pumilum, strictum, multicaule foliis brevissime lobatis, denticulato-serratis, denticulis acuminatis; fructibus edulibus.

Hab. in Canada.

V. Opulus, β . *Pimina* (from colloquial name in Canada) is, of course, *V. trilobum*, γ . *edule*, not only by the clear description but by the specimen of it preserved in the Michaux herbarium at Paris, which I examined first in 1903, which is characteristic *V. pauciflorum* La Pylaie. This, as above indicated, was properly, but quite unintelligently, published by Rafinesque in 1808 as *V. edule*, lack of understanding where nomenclatural transfers and realignments are concerned often being glorified over clear understanding of the characters of the plants! Rafinesque (1808), forecasting a work never published, enumerated scores of *nomina nuda* but by associating some of his binomials with properly described plants of others he got by. In a group of new binomials based upon American plants of Michaux and including *Potamogeton epihydrus*, *P. foliosus* and others which are regularly taken up, Rafinesque had "*Viburnum edulum* [error for *edule*], *V. opulus* var. of *Mich.*" Rafinesque, by giving no description, merely rested his *V. edule* upon *V. Opulus*, var. *edule* Michx., which is *V. pauciflorum* La Pylaie ex Torr. & Gray (1841). Pursh, however, with as little understanding of the actual Michaux material as Rafinesque, boggled things, for he added to his description of *V. edule* (1814) the glandular petioles and neutral marginal flowers of *V. Opulus* and *V. trilobum* ("petiolis glandulosis, cymis radiatis"), although citing Michaux's variety as the source of the name. It thus followed, that, taking their conception of *V. edule*, not from the Michaux material, but from Pursh's misrepresentation of it, the name *V. edule* Raf. (not Pursh) has been regularly assigned to the synonymy either of *V. Opulus* or its American representative, *V. trilobum*.

Later, in 1838, Rafinesque got hold of material from Labrador of the small shrub, without stipules and petiolar glands (the only member of the section growing in Labrador) and gave a lucid account of it as *V. Opulus pauciflorum*, this trinomial being erroneously rendered in Index Kewensis as a binomial *V. "pauciflorum*

Rafin. Alsog. Am. 58"; and, most unfortunately, Rafinesque's trinomial has been accepted as a binomial by Robinson & Fernald and some others, instead of the properly published binomial *V. pauciflorum* La Pylaie ex Torr. & Gray (1841) or, as above shown, *V. edule* Raf. (1808).

House, making the combination *V. eradiatum* (Oakes) House (1921), supposed that there was a *V. pauciflorum* Raf. (1838), House's *V. eradiatum* being "*Viburnum pauciflorum* Pylaie; Torr. & Gray, Fl. N. Am. (2): 17. 1841. Not Raf. Alsog. Am. 58. 1838". Had House carefully compared the description in Torrey & Gray with that of Rafinesque (1838) he would have found that they both emphasized the most important characters: lack of stipules and usually of petiolar glands, slight lobing of blade, small cymes on lateral shoots, etc. Here is Rafinesque's account of 1838, from which it is clear that he did not know his own *V. edule* of 1808 but interpreted the latter from Pursh's inaccurate later description:

251. *Vib. Op. pauciflorum* Raf. ramulis teretis verrucosis, petiolis nudis sine gland. vel stipulis, fol. latovatis non trilobis, basi rotundatis vel subcord. serratis glabris; cymis pedunc. paucifl. vel trifloris, fruct. rubris subrot. compressis—apparently different from *V. edule* [as defined by Pursh] with glandular petiols and trilobe leaves. From Labrador, stem thick rubicund, with small white warts, many bifoliate lateral shoots.

Torrey & Gray's account of the La Pylaie plant (from Newfoundland) is so readily available that I merely quote phrases: "leaves . . . slightly 3-lobed or incised at summit . . .; petioles destitute of stipuliform appendages; cymes (small and simple) pedunculate, terminating the short lateral branches." That this account, in 1841, of the Squashberry of Newfoundland was based on specimens similar to those which Rafinesque described in 1838 is apparent. Unfortunately, the long-established name *V. pauciflorum*, accompanied in both cases by a clear diagnosis, has to give way to the technically correct, though by its author not understood name *V. edule* Raf. (1808).

A NEW LOCALITY FOR *SOLIDAGO SHORTII*.—*Solidago Shortii* T. & G. was described from specimens collected by Dr. C. W. Short in 1840 on Rock Island, an island at the Falls of the Ohio River at Louisville, Kentucky. So far as known, the species has not until recently been collected elsewhere.

In September, 1939, the writer discovered *Solidago Shortii* growing in abundance in a rather barren over-grazed hillside pasture in Nicholas County, Kentucky, not far from Blue Licks. This goldenrod attracted attention because it is shorter in stature and stiffer than other members of its group. Its rather rigid glabrous leaves also set it apart from related species. Specimens sent to the Gray Herbarium were compared with Short's material by Mr. Weatherby and Prof. Fernald who verify the determination.

The Blue Licks locality is one hundred miles in a straight line from the type locality. The species is abundant for a short distance north, south, and west of Blue Licks; it occurs in the three counties (Nicholas, Robertson and Fleming) which come together near Blue Licks. A question naturally arises concerning features which may be connected with the distribution of this local endemic species. The seeds of *Solidago* are well adapted to wind dispersal, yet this species is not generally distributed. Certainly there is nothing peculiar or unique in the Blue Licks habitat. In thinking of Rock Island and of Blue Licks, one cannot but conjecture as to the possibility that buffaloes played a part in the dispersal of seed. The Falls of the Ohio are known to have been one of the important crossings of the Ohio River used by countless hundreds of buffaloes. Blue Lick Springs was a focal point of several important buffalo traces. Buffaloes had the peculiar habit of "wallowing" in muddy places, especially about "licks" such as Blue Lick Springs; in this way they became coated with mud which could have contained many seeds. They are known to have traveled rapidly from place to place, often covering great distances. Seed accidentally picked up at either locality could easily have been transported to the other place.—E. LUCY BRAUN, University of Cincinnati, Cincinnati, Ohio.

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